Chapter 4. Creating Man-made Materials in Cycles

In this chapter, we will cover the following recipes:

- Creating a generic plastic material
- Creating a Bakelite material
- Creating an expanded polystyrene material
- Creating a clear (glassy) polystyrene material
- Creating a rubber material
- Creating an antique bronze material with procedurals
- Creating a multipurpose metal node group
- Creating a rusty metal material with procedurals
- Creating a wood material with procedurals

Introduction

On most occasions, artificial materials are quite easy to recreate in Cycles.

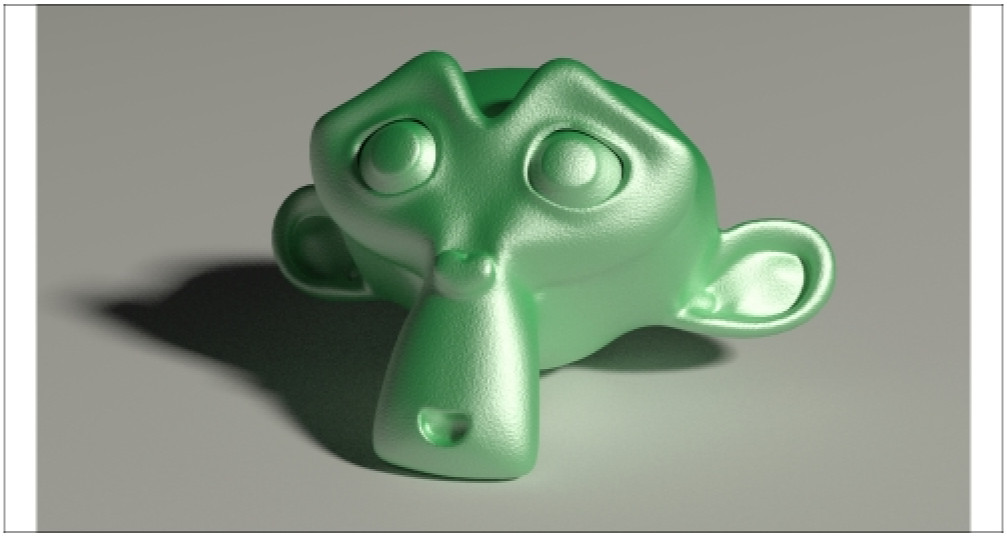
In the previous chapters we discussed the mechanics of building materials through procedural textures using the Cycles render engine. In this chapter, we'll discuss some artificial materials. Starting with one or two examples of simple materials, such as plastic, we will progress to more complex materials. We'll also take a look at the decayed material shaders and treat them as worn or rusty metals.

Note that in Cycles, it's not actually necessary to add the nodes for the texture mapping coordinates to any shader network. This is because, by default and if not otherwise specified, Cycles automatically uses the **Generated** mapping coordinates for procedural textures and any existing UV coordinate layer for the image textures.

Anyway, I think it's a good habit to add both the **Texture Coordinate** and the **Mapping** nodes to all the materials to permit easy reutilization of the shaders on different objects with different mapping options, scales, and locations.

Creating a generic plastic material

In this recipe, we will create a generic plastic shader and add slight granularity (optional) to the surface, as shown in the following screenshot:



The generic plastic material as it appears in the final rendering

Getting ready...

Start Blender and load the `9931OS_Suzanne_start.blend` file. This is a prepared scene, with Suzanne (the monkey head primitive that is Blender's mascot) leaning on a white Plane, a Camera, a mesh-light emitting slightly yellowish light, and a low-intensity gray World.

Note

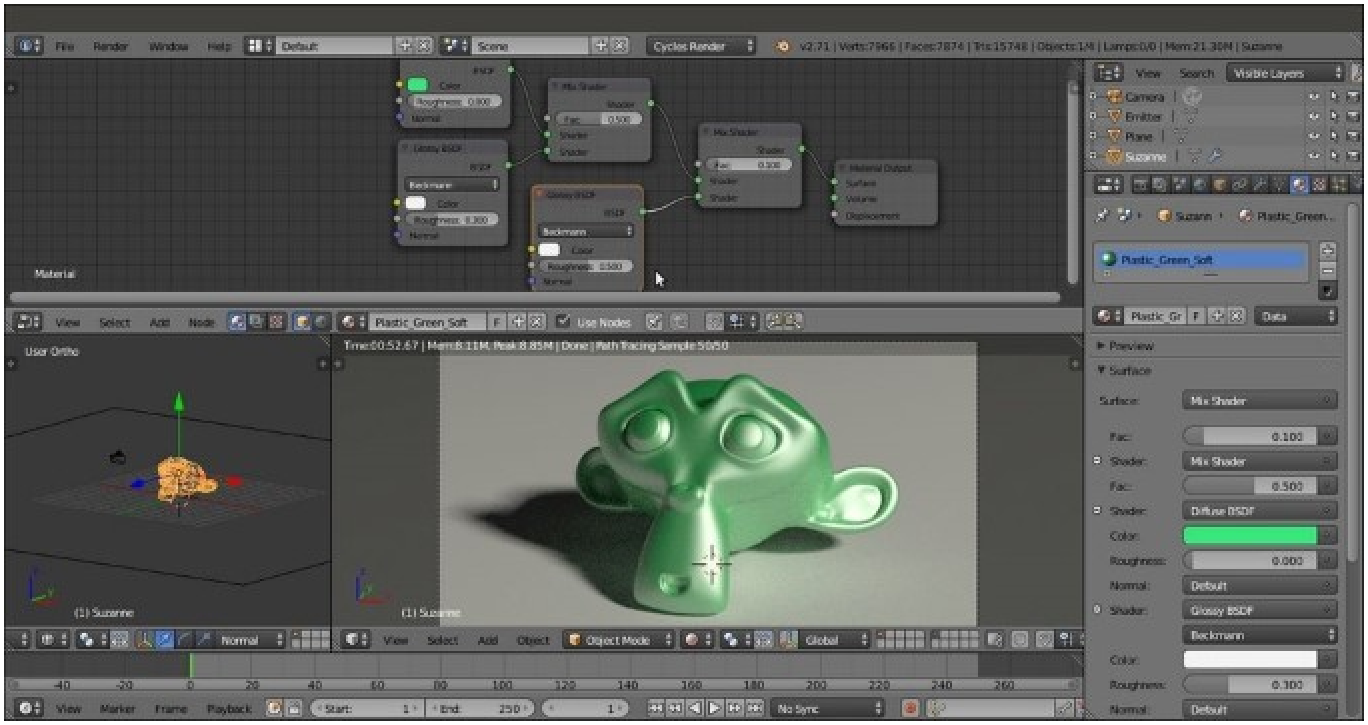
We'll use a lot this file as starting point for several of our recipes.

How to do it...

Now we will go straight to creation of the material, so follow these steps:

1. Select **Suzanne** and click on **New** in the **Material** window under the **Properties** panel or in the **Node Editor** toolbar. Rename the material `Plastic_Green_Soft`.
2. Set the **Viewport Shading** mode of the **Camera** view to **Rendered** by moving the mouse into the 3D view and pressing *Shift* + *Z*.
3. In the **Material** window under the **Properties** panel, switch the **Diffuse BSDF** shader with a **Mix Shader** node, and in the first **Shader** slot, select a **Diffuse BSDF** shader. In the second **Shader** slot, select a **Glossy BSDF** node.
4. Change the **Diffuse BSDF** color to bright green (change the values of **R** to `0.040`, **G** to `0.800`, and **B** to `0.190`) and the **Glossy BSDF** shader's **Roughness** value to `0.300`.

5. Press *Shift* + *D* to duplicate the **Mix Shader** node, and paste it between the first **Mix Shader** node and the **Material Output** node. Set the **Fac** value to `0.100`.
6. Duplicate the **Glossy BSDF** node and connect its output to the second input socket of the second **Mix Shader** node. Set its **Roughness** value to `0.500`, as shown in the following screenshot:



v2.71 | Verts:7966 | Faces:7874 | Tris:15748 | Objects:1/4 | Lamps:0/0 | Mem:21.30M | Suzanne

Time:00:52.67 | Mem:8.11M, Peak:8.85M | Done | Path Tracing Sample 50/50

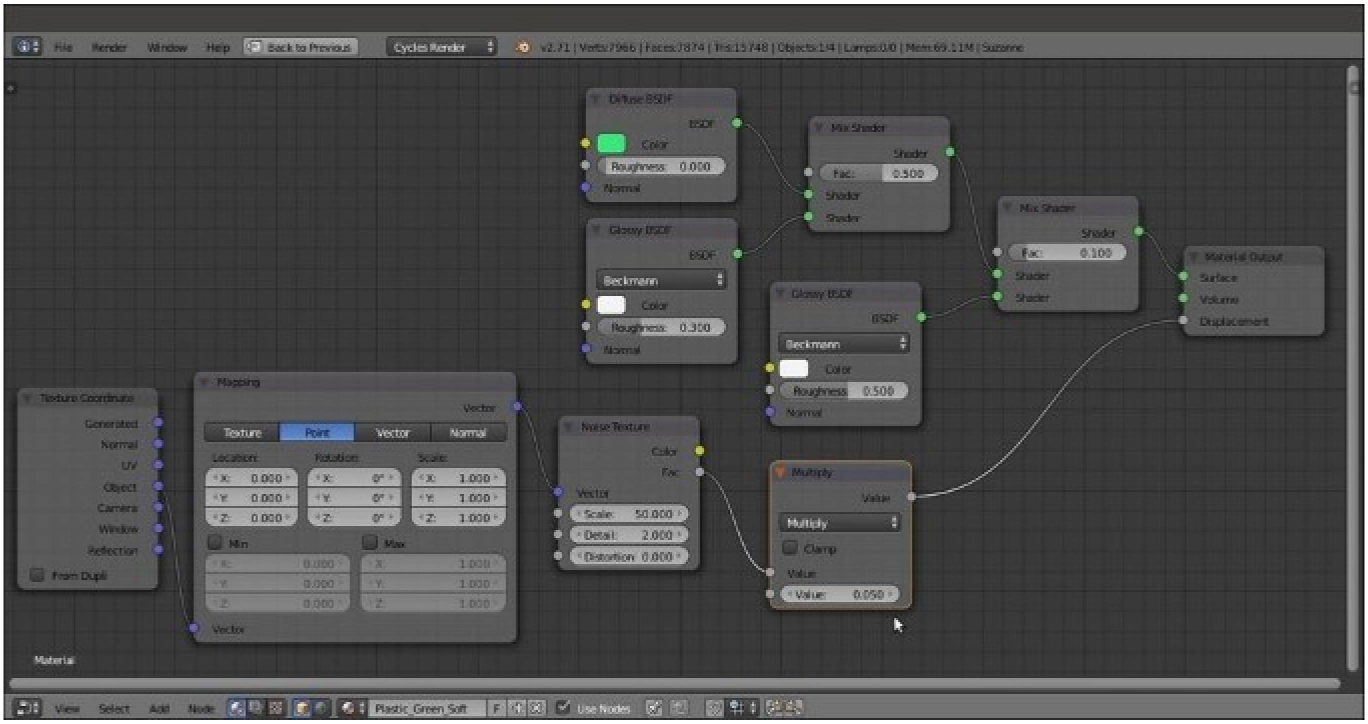
Plastic_Green_Soft

Surface: Mix Shader
Fac: 0.100
Shader: Mix Shader
Fac: 0.500
Shader: Diffuse BSDF
Color: 🟩
Roughness: 0.000
Normal: Default
Shader: Glossy BSDF
Beckmann
Color: ⬜
Roughness: 0.300
Normal: Default

Start: 1 End: 250

A screenshot of the entire Blender interface with the basic shader nodes in the Node Editor window at the top

7. Add a **Noise Texture** node (press *Shift* + *A* and navigate to **Texture** | **Noise Texture**), a **Texture Coordinate** node (press *Shift* + *A* and navigate to **Input** | **Texture Coordinate**), and a **Mapping** node (press *Shift* + *A* and navigate to **Vector** | **Mapping**).
8. Connect the **Object** output of the **Texture Coordinate** node to the **Vector** input of the **Mapping** node, and the output of this node to the input of the **Noise Texture** node.
9. Set the **Noise Texture** node's **Scale** value to `50.000`. Add a **Math** node (press *Shift* + *A* and navigate to **Converter** | **Math**). Connect the **Noise Texture** node's **Fac** output to the first **Value** input of the **Math** node. Set the **Math** node's **Operation** to **Multiply** and second **Value** to `0.050`. Connect its **Value** output to the **Displacement** input socket of the **Material Output** node, as shown in the following screenshot:



The very simple bump effect added to the shader nodes by connecting the output of the Noise Texture node to the Displacement input socket of the Material Output node

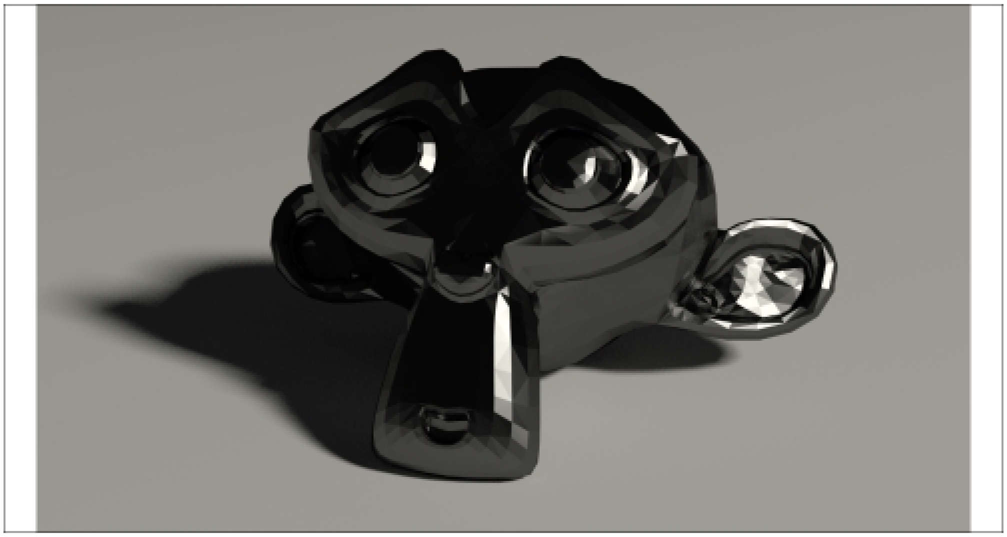
10. Save the file as `Plastic_soft.blend`.

How it works...

This is one of the simplest materials you can build in Cycles. It consists of a colored **Diffuse BSDF** component mixed at 50 percent with a white **Glossy BSDF** shader and another low **Glossy BSDF** shader to make the specular effect more diffused. A tiny **Noise Texture** node, connected directly to the **Displacement** input of the **Material Output** node, adds a slightly dotted bump effect to the whole material, as if it is some kind of industrial plastic used for toys.

Creating a Bakelite material

Bakelite is a very common type of plastic and can be found in a lot of different colors and patterns. In this recipe, we will create the black type (which was once really common), as shown in this screenshot:



The black Bakelite material as it appears in the final rendering

Getting ready...

Start Blender and load the `9931OS_Suzanne_start.blend` file again:

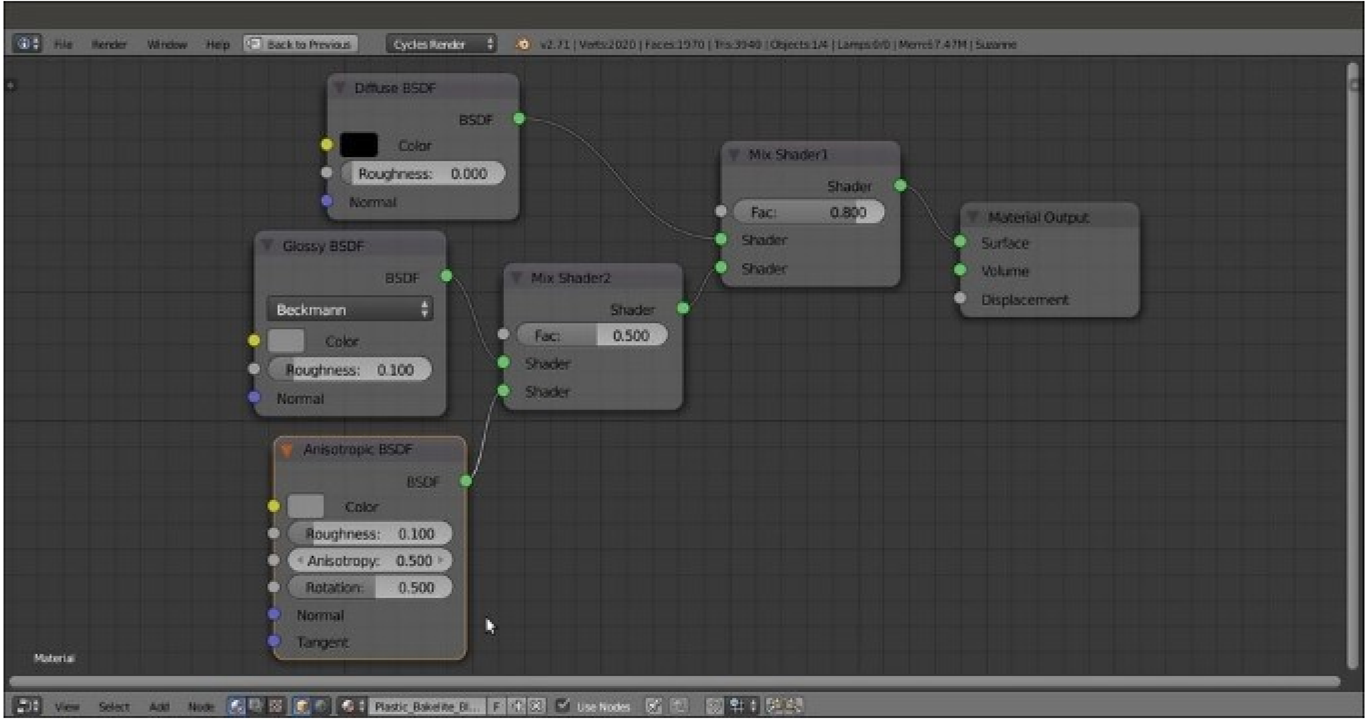
1. With the mouse arrow in the **Camera** view, press the *T* key. Select the **Suzanne** mesh. Go to the **Tools** tab under the **Tool Shelf** panel on the left. Select **Flat** under **Shading**. Press *T* again to close the **Tool Shelf** panel.
2. Go to the **Object modifiers** window in the **Properties** panel. Expand the **Subdivision Surface** modifier panel and set the levels both for **View** and **Render** to `1`.

How to do it...

Now we are going to create the material by performing the following steps:

1. Go to the **Material** window and click on **New** (or do this as usual, in the **Node Editor** toolbar). Rename the material `Plastic_Bakelite_Black`.
2. Set the **Viewport Shading** mode of the **Camera** view to **Rendered**.
3. Switch the **Diffuse BSDF** shader with a **Mix Shader** node, and in the first **Shader** slot, select a **Diffuse BSDF** shader. In the second **Shader** slot, select a **Glossy BSDF** node.
4. Change the **Diffuse BSDF** color to pure black and the **Glossy BSDF** shader color to light gray (**RGB** to `0.253`). Set the **Roughness** value of the **Glossy BSDF** shader to `0.100` and the **Fac** value of the **Mix Shader** node to `0.800`.

5. Press *Shift* + *D* to duplicate the **Mix Shader** node, and paste it between the **Glossy BSDF** shader and the first **Mix Shader** node.
6. With the mouse arrow in the **Node Editor** window, press *N*. Select the first **Mix Shader** node, and in the **Label** slot in the **Active Node** panel on the right, write `Mix Shader1`. Select the second **Mix Shader** node, and in the **Label** slot, write `Mix Shader2`.
7. Add an **Anisotropic BSDF** shader (press *Shift* + *A* and navigate to **Shader** | **Anisotropic BSDF**) and connect its output to the second input socket of the **Mix Shader2** node.
8. Set the **Mix Shader2** node's **Fac** value to `0.500`. Set the **Anisotropic BSDF** node's color to light gray, and set the same color for the **Glossy BSDF** shader (that is, **RGB** to `0.253`). Set the **Glossy BSDF** shader's **Roughness** value to `0.100` and **Rotation** to `0.500` as shown in the following screenshot:



Diffuse BSDF: Roughness: 0.000

Mix Shader1: Fac: 0.800

Glossy BSDF: Beckmann; Roughness: 0.100

Mix Shader2: Fac: 0.500

Anisotropic BSDF: Roughness: 0.100; Anisotropy: 0.500; Rotation: 0.500

Plastic_Bakelite_Bl...

The simple shader network for the basic Bakelite material

9. Save the file as `Plastic_Bakelite.blend`.

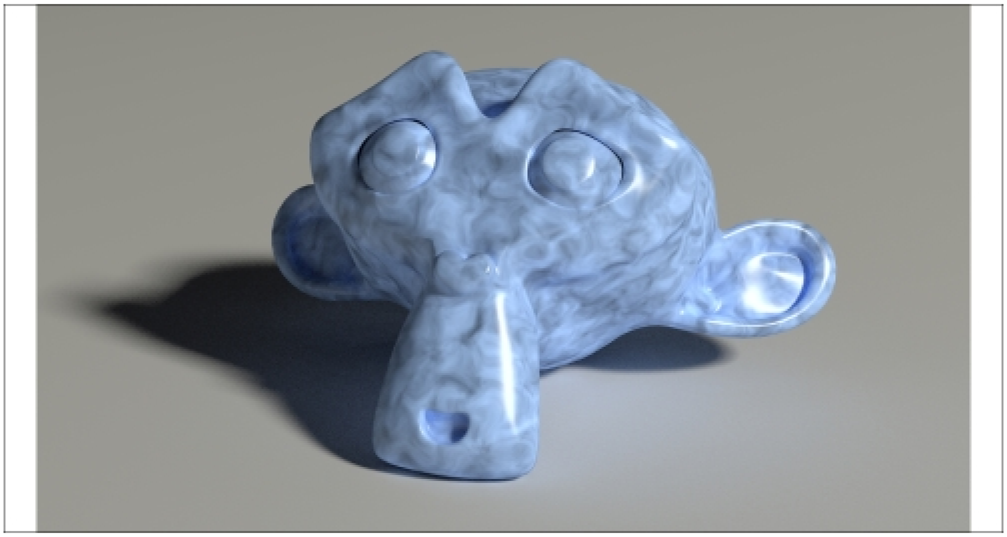
How it works...

Basically, we made the same kind of material as the green plastic material, but this time, we enhanced the reflectivity (mirror) by lowering the **Roughness** value. We also added an **Anisotropic BSDF** specularity effect with the same roughness and color as those for the **Glossy BSDF** shader. The **Rotation** value of the **Anisotropic BSDF** shader sets the flow of the highlights on the mesh. The direction of the specularity rotates as this value increases from `0.000` to `1.000`.

Anisotropy is a method of enhancing image quality of textures on surfaces that are far away and steeply angled with respect to the point of view. An anisotropic surface will change in appearance as it rotates about its geometric normal.

There's more...

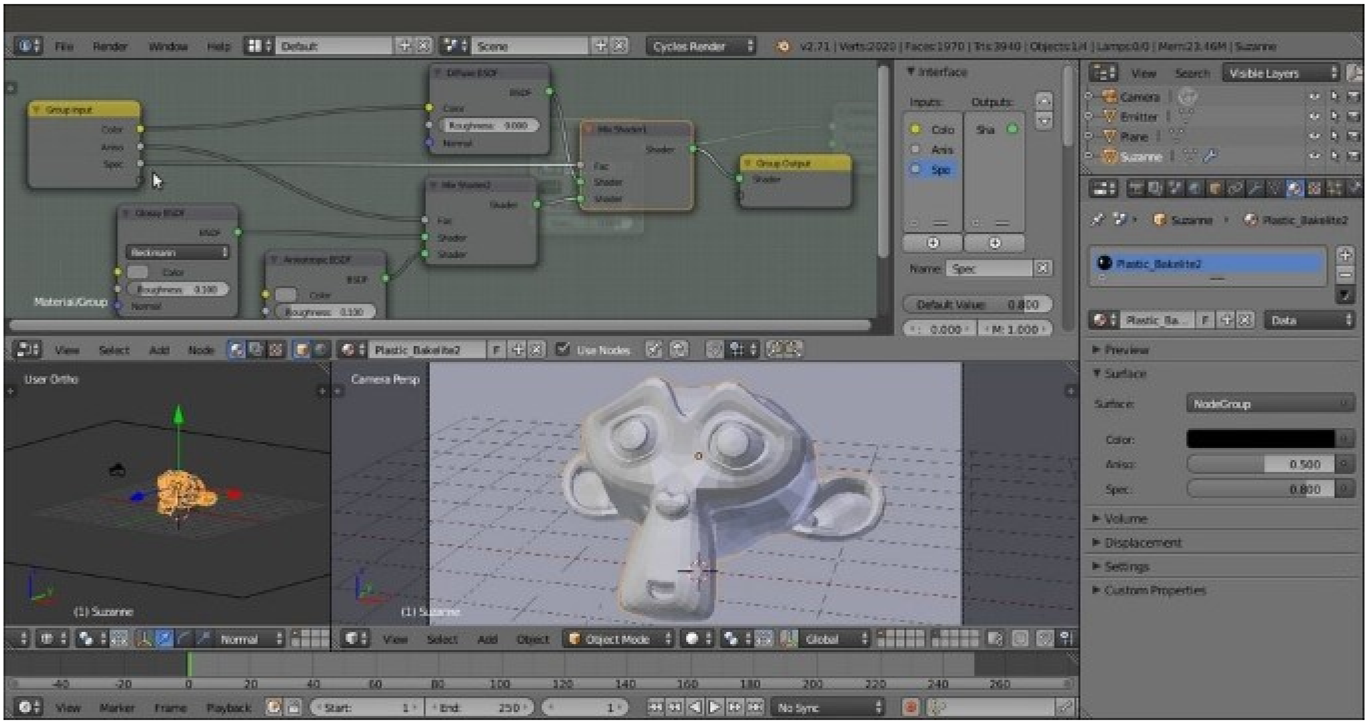
Starting from the black material, let's now try to make a differently processed Bakelite material, as shown in the following screenshot:



A different type of Bakelite

First, we'll make a node group of the Bakelite material by performing the following steps:

1. Click on the material name and rename it `Plastic_Bakelite2`. Then save the file as `Plastic_Bakelite2.blend`.
2. Select the **Diffuse BSDF**, **Glossy BSDF**, **Anisotropic BSDF**, and two **Mix Shader** nodes and press *Ctrl* + *G* to make a group.
3. Click and drag the **Diffuse BSDF** node's **Color** socket into the empty socket of the **Group Input** node. Drag the **Fac** socket of the **Mix Shader2** node, and in the **Interface** subpanel of the **Properties** panel of the **Node Editor** window, rename it `Aniso`. This will drive the influence of the anisotropic shader on the glossy shader. Click and drag the **Fac** socket of the **Mix Shader1** node to the empty socket of **Group Input** node. Rename it `Spec`. This will drive the amount of final specularity of the shader. Here is a screenshot of the creation of the Bakelite node group for your reference:



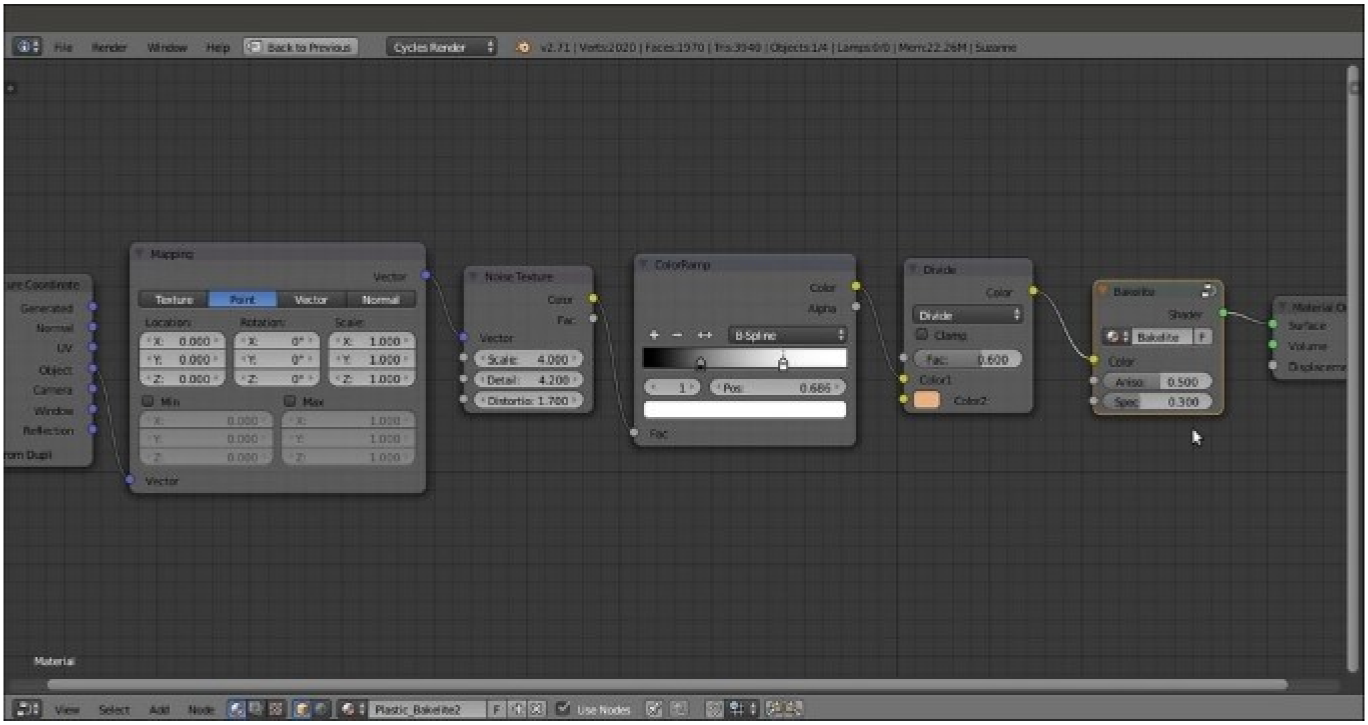
The creation of the Bakelite node group

4. Press *Tab* to close the group. Rename it `Bakelite`.

Now we'll add the nodes needed to create the differently colored material that we decided at the beginning of this section:

1. In the **Node Editor** window, add the following nodes in linear sequence from left to right: a **Texture Coordinate** node (press *Shift* + *A* and navigate to **Input** | **Texture Coordinate**), a **Mapping** node (press *Shift* + *A* and navigate to **Vector** | **Mapping**), a **Noise Texture** node (press *Shift* + *A* and navigate to **Texture** | **Noise Texture**), a **ColorRamp** node (press *Shift* + *A* and navigate to **Converter** | **ColorRamp**), and a **MixRGB** node (press *Shift* + *A* and navigate to **Color** | **MixRGB**).
2. Connect the **Object** output of the **Texture Coordinate** node to the **Vector** input of the **Mapping** node, and the output of this node to the input of the **Noise Texture** node. Connect the **Color** output of the **Noise Texture** node to the **ColorRamp** input socket, and the **Color** output of the **ColorRamp** node to the **Color1** input socket of the **MixRGB** node. Connect the **Color** output of the **MixRGB** node to the **Color** input of the **Bakelite** node group.
3. Set the **Noise Texture** node's **Scale** to `4.000`, **Detail** to `4.200`, and **Distortion** to `1.700`.
4. Set the **ColorRamp** node's **Interpolation** to **B-Spline**. Move the black color marker to position `0.277` and the white color marker to `0.686`.
5. Set **MixRGB** node's **Blend Type** to **Divide** (but remember to experiment with the other types as well) and the **Fac** value to `0.600`. Change the **Color2** values of **R** to `0.799`, **G** to `0.442`, and **B** to `0.220`.

6. In the **Bakelite** node group interface, set the **Spec** value to `0.300`, as shown in the following screenshot:



Mapping: Location: X: 0.000, Y: 0.000, Z: 0.000; Rotation: X: 0°, Y: 0°, Z: 0°; Scale: X: 1.000, Y: 1.000, Z: 1.000
☐ Min: X: 0.000, Y: 0.000, Z: 0.000
☐ Max: X: 1.000, Y: 1.000, Z: 1.000

Noise Texture: Scale: 4.000; Detail: 4.200; Distortio: 1.700

ColorRamp: B-Spline; 1; Pos: 0.686

Divide: Divide; ☐ Clamp; Fac: 0.600

Bakelite: Bakelite F; Aniso: 0.500; Spec: 0.300

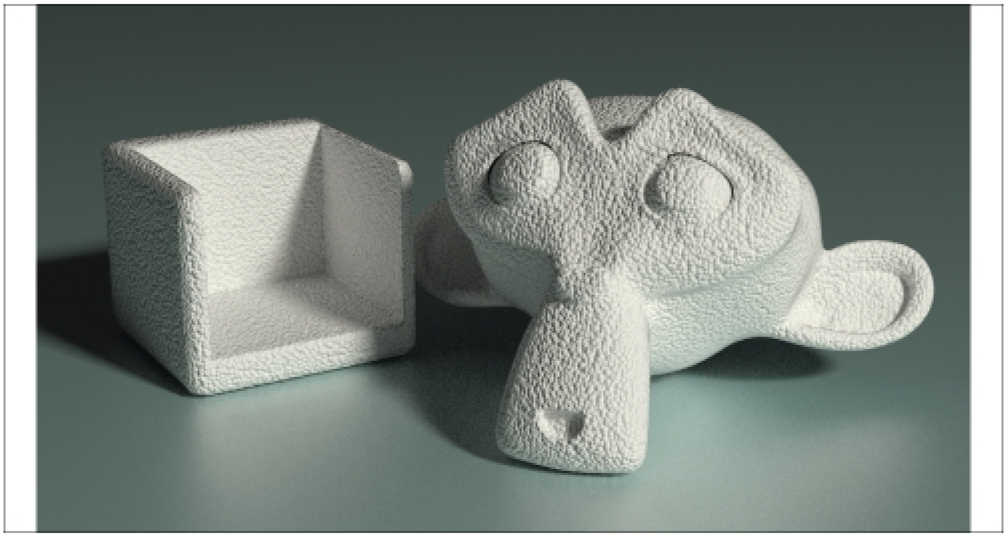
Plastic_Bakelite2 F

Adding texture details to the Bakelite node group

7. You can also smooth the **Suzanne** mesh in the **Tool Shelf** panel (press *T*) and increase the **Subdivision** levels of the **Subdivision Surface** modifier to `2`.
8. Save the file.

Creating an expanded polystyrene material

In this recipe, we will create a classic white expanded polystyrene material, as shown in this screenshot:



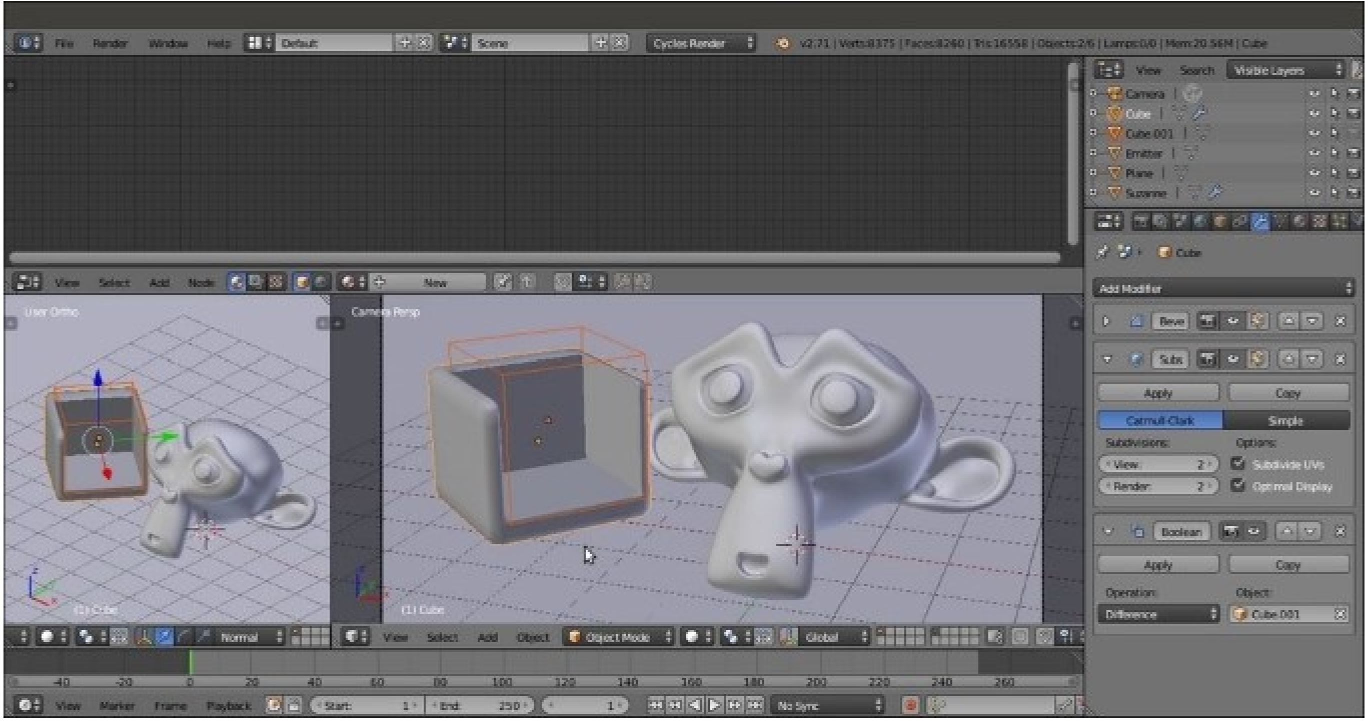
The white expanded polystyrene material as it appears in the final rendering

Getting ready...

First, let's prepare the scene:

1. Start Blender and load the `9931OS_Suzanne_start.blend` file. Add a Cube primitive to the scene and place it leaning on the Plane, close to Suzanne. Move it upwards by 1 Blender unit.
2. With the mouse arrow in the **Camera** view, press *Shift* + *F* to enter **Walk Mode** (in this mode, you can press the *W* key to go forward, press *S* to go back, move the mouse to decide the direction, and click or press *Enter* to confirm). Adjust the **Camera** position so as to center the two objects in the frame.
3. Select the **Cube** object and go to the **Object modifiers** window. Assign a **Boolean** modifier.
4. Press *Shift* + *D* to duplicate the Cube, and move it a bit upward (press *G*, then press *Z*, enter *.4*, and press *Enter*). Reselect the first **Cube**, and in the **Object** field of the **Boolean** modifier panel, select the second Cube (**Cube.001**). Set **Operation** to **Difference**. Go to **Edit Mode** and scale all the vertices a bit larger on the *x* and *y* axes (press *S*, then press *Shift* + *Z*, enter *1.200*, and press *Enter*).
5. Exit **Edit Mode** and reselect **Cube.001**. Move it a bit on the *x* axis (press *G*, then press *X*, enter *.4*, and press *Enter*).
6. Go to the **Object** window and set **Maximum Draw Type** to **Wire**. Then go to the **Ray Visibility** subpanel (usually at the bottom) and uncheck all the items. This way, **Cube.001** becomes visible in the 3D view, but is not yet rendered in the preview.

7. Just to be sure that the second cube is not visible (the previous step should be enough for the final rendering), go to **Outliner** and click on the camera icon to the right of the **Cube.001** item.
8. Select the first **Cube** and assign a **Bevel** modifier. Set the **Width** value to `0.0200`. Move it higher in the stack of modifiers and place it before the **Boolean** modifier.
9. Assign a **Subdivision Surface** modifier and set both the **Subdivisions** levels to `2`. Check the **Optimal Display** item and move it higher in the stack. Place it before the **Boolean** modifier but after the **Bevel** modifier.
10. Press *T* to call the **Tool Shelf** panel. Set the **Cube** shading to **Smooth**.
11. Press *Shift*, select both **Cube** and the **Cube.001** objects, and rotate them on *z* axis towards the **Camera** (press *R*, then press *Z*, enter *-40*, and then press *Enter*).
12. Press *T* to close the **Tool Shelf** panel. The following screenshot shows the process of building the box object:



Subdivisions: View: 2 Render: 2

Options: ☑ Subdivide UVs ☑ Optimal Display

Operation: Difference

Object: Cube.001

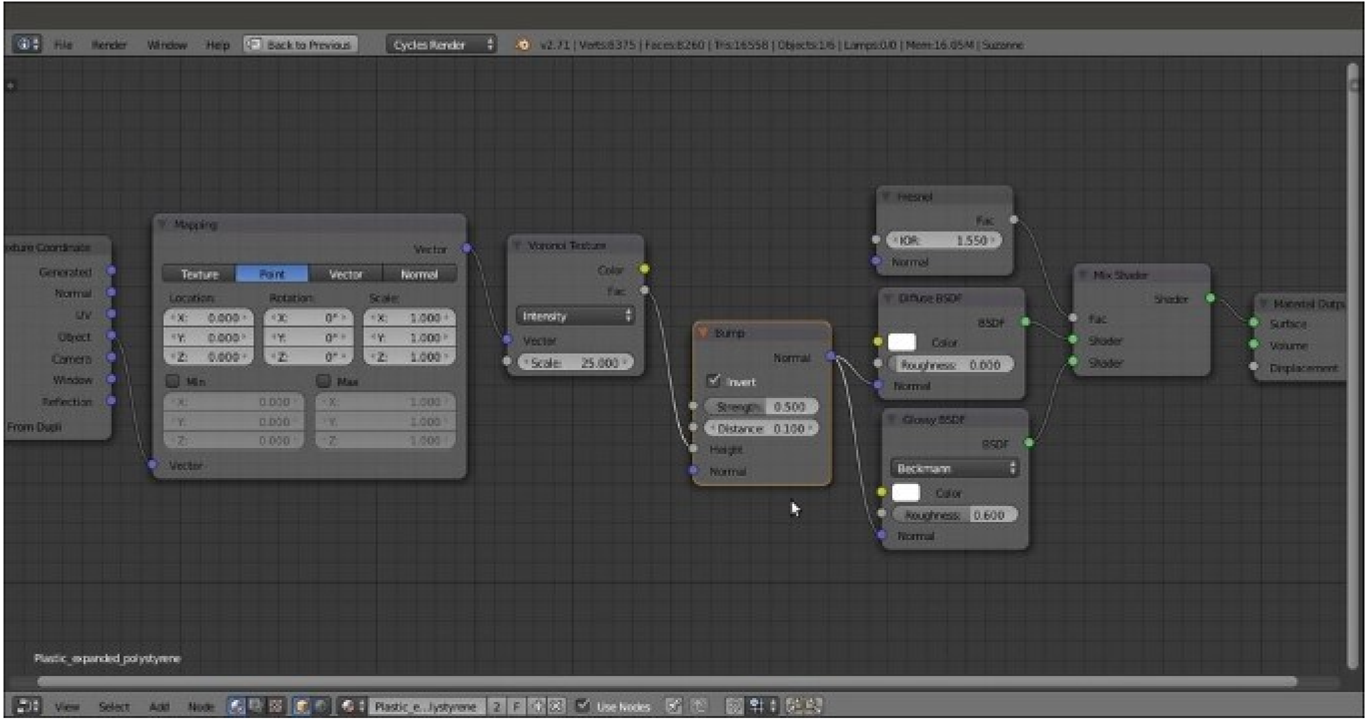
Building the box object by a Boolean modifier

13. Select the **Plane** object, and in the **Material** window, switch the **Diffuse BSDF** shader with a **Mix Shader** node. Then, in the **Shader** slots, select a **Diffuse BSDF** node and a **Glossy BSDF** shader node. Add a **Layer Weight** node (press *Shift* + *A* and navigate to **Input** | **Layer Weight**) and connect the **Facing** output to the **Fac** input socket of the **Mix Shader** node. Set the color of the **Diffuse BSDF** node as follows: **R** to `0.530`, **G** to `0.800`, and **B** to `0.800`.

How to do it...

Now we are going to create the material by performing the following steps:

1. Select **Suzanne** and click on **New** in the **Material** window under the **Properties** panel or in the **Node Editor** toolbar. Rename the material `Plastic_expanded_polystyrene`.
2. Switch the **Diffuse BSDF** shader with a **Mix Shader** node, and in the first **Shader** slot, select a **Diffuse BSDF** shader. In the second **Shader** slot, select a **Glossy BSDF** node.
3. Set the **Diffuse BSDF** shader color and the **Glossy** shader color to pure white. Set the **Roughness** value of the **Glossy BSDF** shader to `0.600`. Add a **Fresnel** node (press *Shift* + *A* and navigate to **Input** | **Fresnel**). Connect its output to the **Fac** input socket of the **Mix Shader** node. Set the **IOR** value to `1.550`.
4. Add a **Voronoi Texture** node (press *Shift* + *A* and navigate to **Texture** | **Voronoi Texture**), a **Texture Coordinate** node (press *Shift* + *A* and navigate to **Input** | **Texture Coordinate**), and a **Mapping** node (press *Shift* + *A* and navigate to **Vector** | **Mapping**).
5. Connect the **Object** output of the **Texture Coordinate** node to the **Vector** input of the **Mapping** node, and the output of this node to the **Vector** input of the **Voronoi Texture** node.
6. Set the **Voronoi Texture** node's **Scale** value to `25.000`. Add a **Bump** node (press *Shift* + *A* and navigate to **Vector** | **Bump**). Connect the **Fac** output of the **Voronoi Texture** node to the **Height** input socket of the **Bump** node, and the output of this node to the **Normal** input sockets of the **Diffuse BSDF** and **Glossy BSDF** shader nodes.
7. Check the **Invert** item on the **Bump** node and set the **Strength** value to `0.500`, as shown in the following screenshot:



The white expanded polystyrene material network

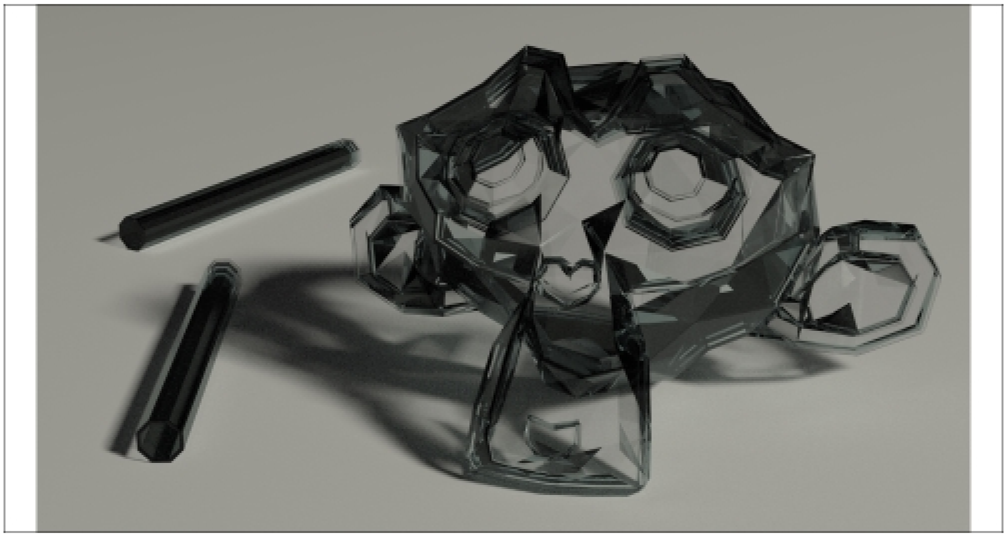
8. Press *Shift* and select the **Cube** object and **Suzanne**. Then press *Ctrl* + *L*, and in the **Make Links** pop-up menu, select the **Material** item to assign the material of the active object to the other object.
9. Save the file as `Plastic_expanded_polystyrene.blend`.

How it works...

You have probably noticed that this recipe is simply a variation of the generic plastic shader. We changed the color to white, and instead of **Noise Texture**, we used a **Voronoi Texture** node with a different scale to add the typical polystyrene pattern. Then, by increasing the **Roughness** value of the **Glossy BSDF** shader, we made the specularity more diffused.

Creating a clear (glassy) polystyrene material

In this recipe, we will create a glassy polystyrene material (which you find on the body of ballpoint pens), as shown in the following screenshot:



The glassy polystyrene material as it appears in the final rendering

Getting ready...

First, we need the usual preparation:

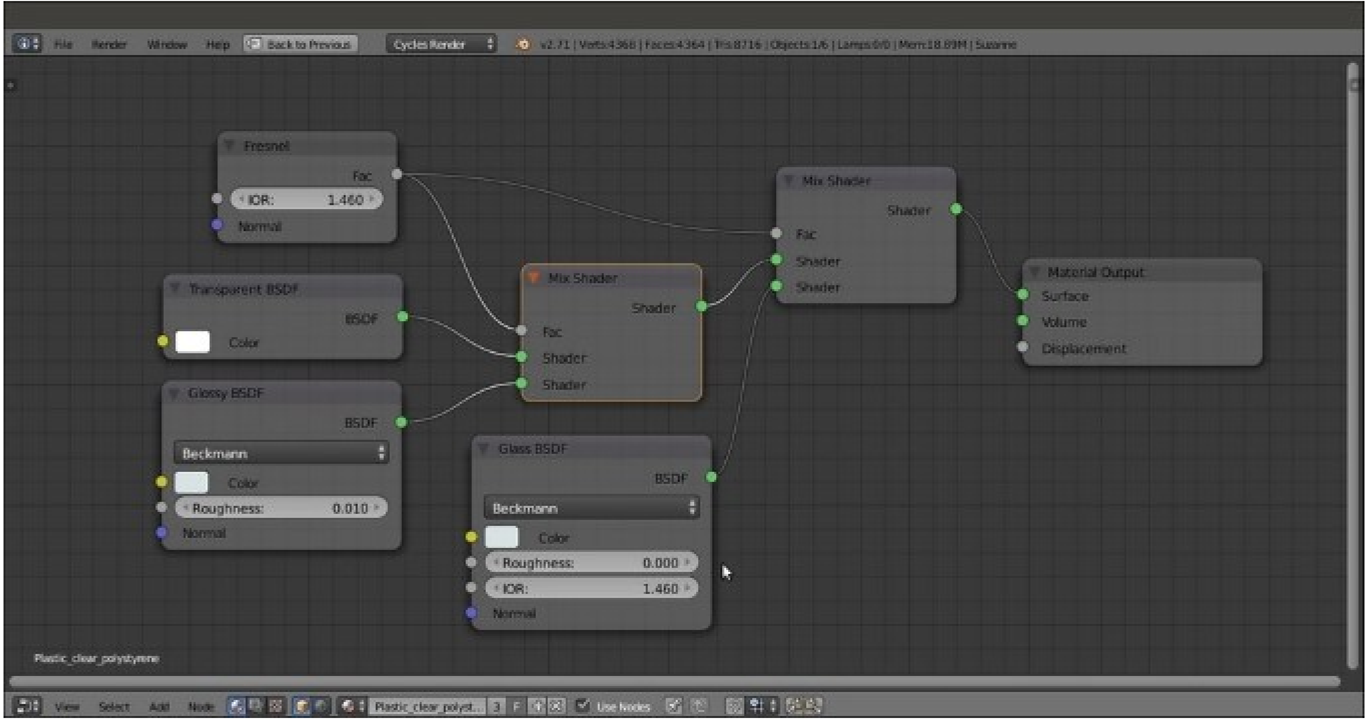
1. Start Blender and load the `9931OS_Suzanne_start.blend` file.
2. Select the **Suzanne** mesh and press *T*. In the **Tool Shelf** panel on the left side, select **Flat** under **Shading**. Press *T* again to close the **Tool Shelf** panel.
3. Go to the **Object modifiers** window in the **Properties** panel and delete the **Subdivision Surface** modifier. Add a **Solidify** modifier and set the **Thickness** value to `0.0350`. Add a **Bevel** modifier and set the **Width** value to `0.0050`. Uncheck the **Clamp Overlap** item.

How to do it...

Now we are going to create the material by performing the following steps:

1. Go to the **Material** window and click on **New** (or as usual, go to the **Node Editor** toolbar). Rename the material `Plastic_clear_polystyrene`.
2. Set the **Viewport Shading** mode of the **Camera** view to **Rendered**.
3. Switch the **Diffuse BSDF** shader with a **Mix Shader** node, and in the first **Shader** slot, select a **Mix Shader** node again. In the second **Shader** slot, select a **Glass BSDF** node. Set its **IOR** value to `1.460`. Change the values of **R** to `0.688`, **G** to `0.758`, and **B** to `0.758`.

4. Go to the second **Mix Shader** node, and in its first **Shader** slot, select a **Transparent BSDF**. In the second **Shader** slot, select a **Glossy BSDF** node. Change the **Glossy BSDF** node color values for **R** to `0.688`, **G** to `0.758`, and **B** to `0.758`. Change the **Roughness** value to `0.010`.
5. Add a **Fresnel** node (press *Shift* + *A* and navigate to **Input** | **Fresnel**) and connect it to the **Fac** input sockets of both the **Mix Shader** nodes. Set the **IOR** value to `1.460`, as shown in the following screenshot:



Fresnel: IOR: 1.460

Glossy BSDF: Beckmann, Roughness: 0.010

Glass BSDF: Beckmann, Roughness: 0.000, IOR: 1.460

Plastic_clear_polyst...

☑ Use Nodes

The completed network for the glassy polystyrene material

6. Save the file as `Plastic_clear_polystyrene.blend`.

Creating a rubber material

In this recipe, we will create a generic rubber shader, as shown in this screenshot:

The rubber material as it appears in the final rendering

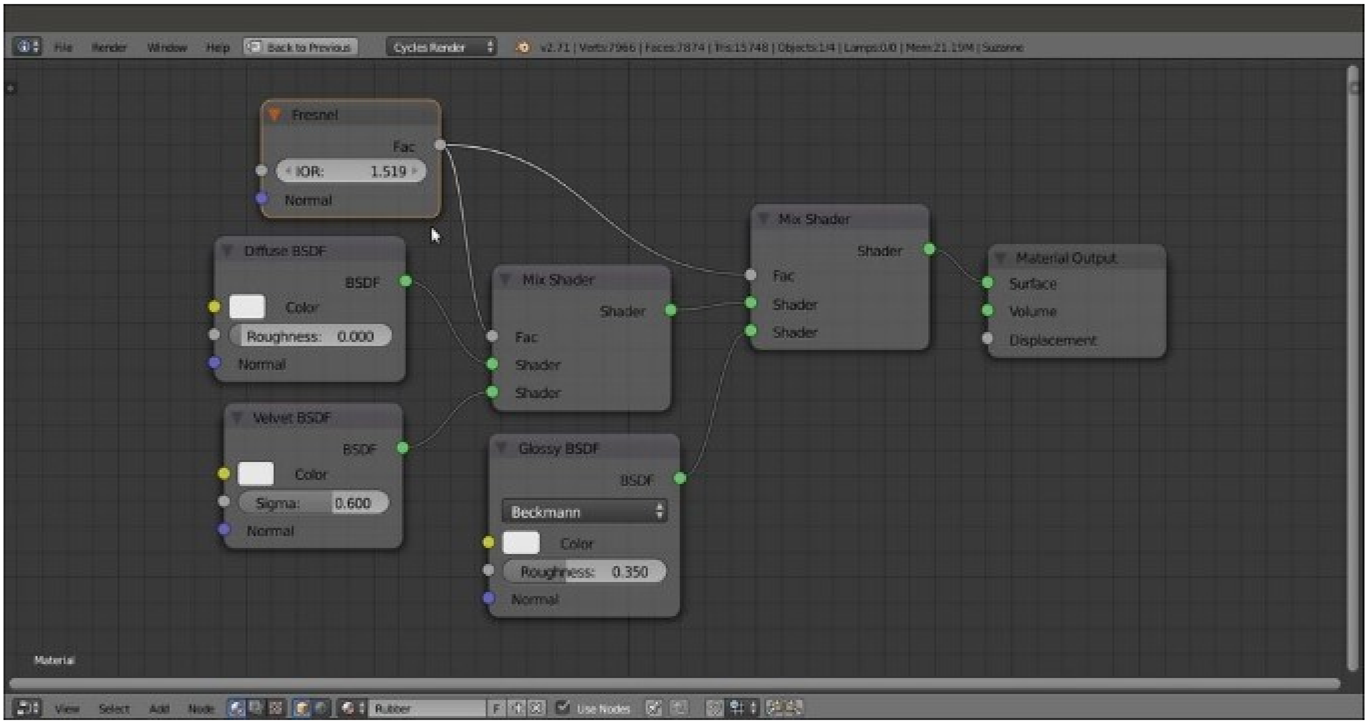
Getting ready...

Start Blender and load the `9931OS_Suzanne_start.blend` file.

How to do it...

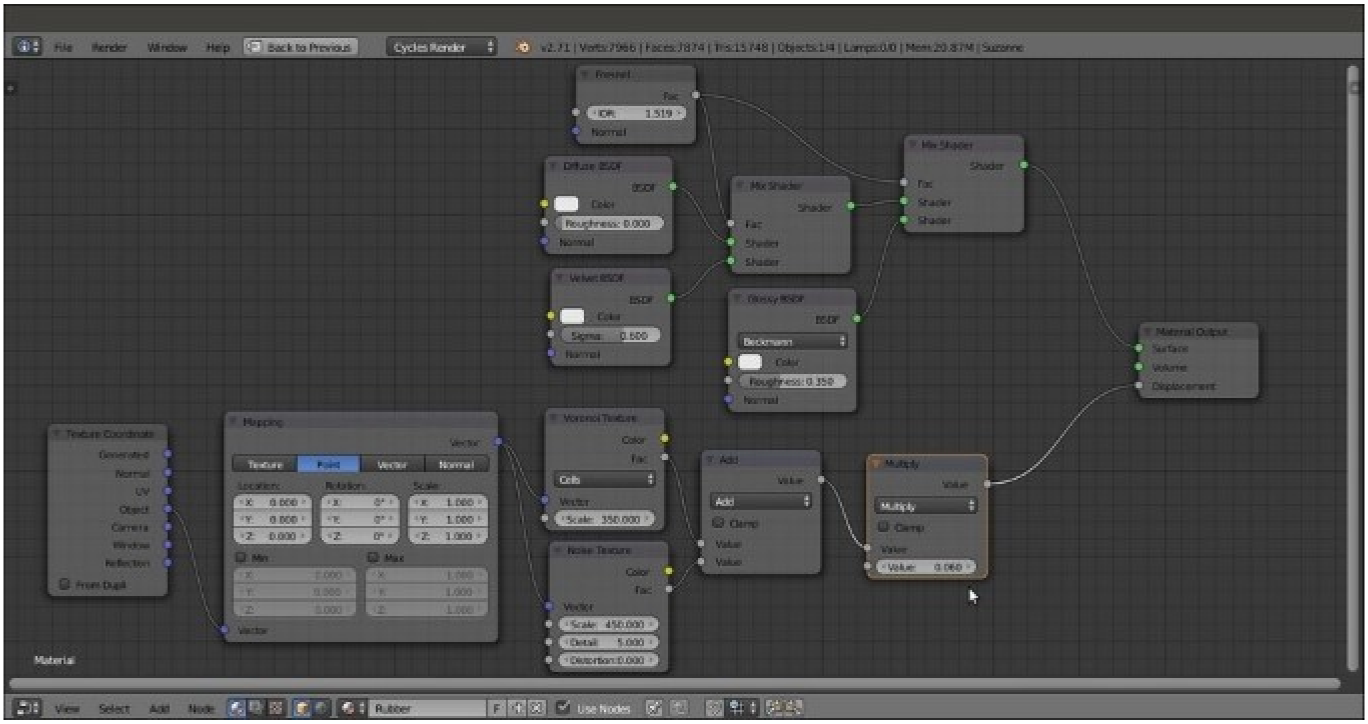
Now we are going to create the material by performing the following steps:

1. Click on **New** in the **Material** window under the **Properties** panel or in the **Node Editor** toolbar. Rename the material `Rubber`.
2. With the mouse arrow in the **Camera** view, press *Shift* + *Z* to set it to **Rendered** mode.
3. Switch the **Diffuse BSDF** shader with a **Mix Shader** node, and in the second **Shader** slot, select a **Glossy BSDF** node. In the first **Shader** slot, select a new **Mix Shader** node. Set the **Glossy BSDF** node's **Roughness** value to `0.350`.
4. Go to the second **Mix Shader** node, and in the first **Shader** slot, select a **Diffuse BSDF** node. In the second **Shader** slot, select a **Velvet BSDF** node. Set the **Velvet BSDF** shader node's **Sigma** value to `0.600`.
5. Add a **Fresnel** node (press *Shift* + *A* and navigate to **Input** | **Fresnel**) and connect it to the **Fac** input of both the **Mix Shader** nodes. Set the **IOR** value to `1.519`, as shown in the following screenshot:



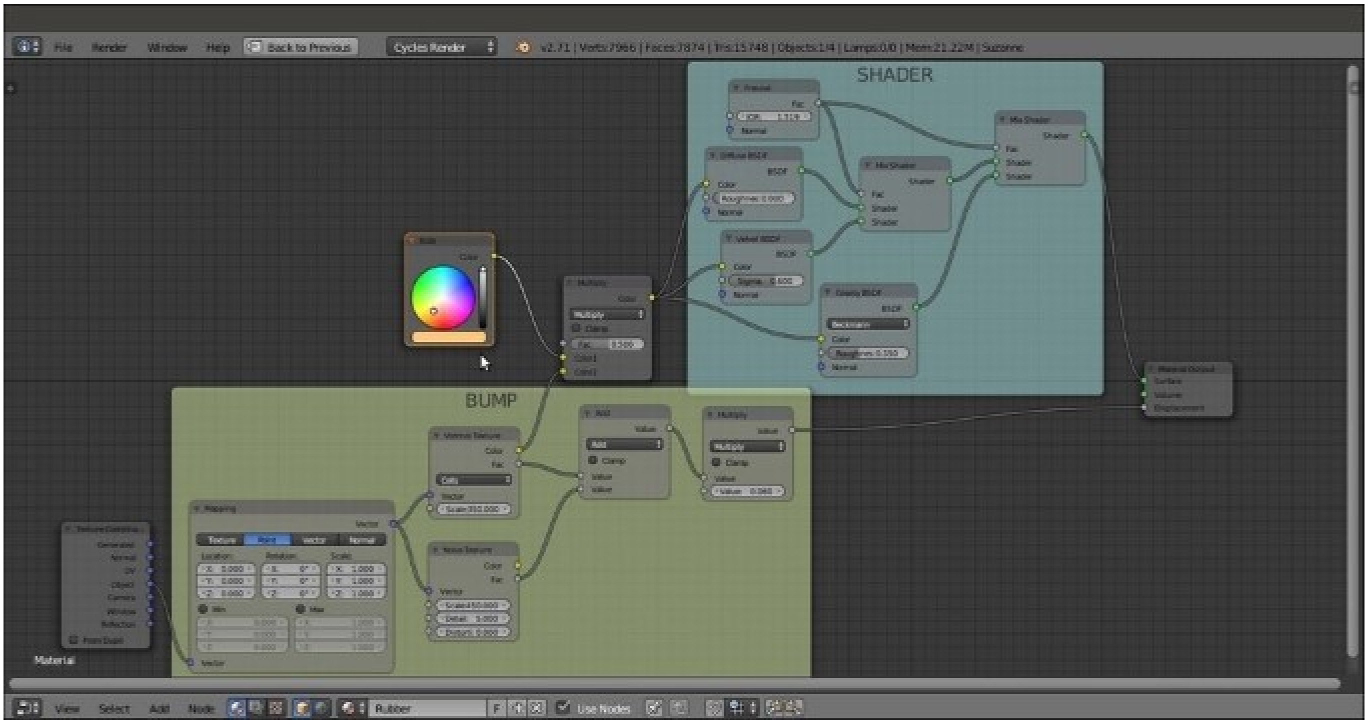
The basic shader network

6. Add a **Texture Coordinate** node (press *Shift* + *A* and navigate to **Input** | **Texture Coordinate**), a **Mapping** node (press *Shift* + *A* and navigate to **Vector** | **Mapping**), a **Voronoi Texture** node, and a **Noise Texture** node (press *Shift* + *A* and navigate to **Texture** | **Voronoi Texture**, do the same to add **Noise Texture** node).
7. Connect the **Object** output of the **Texture Coordinate** node to the **Vector** input of the **Mapping** node, and the latter's output to the **Vector** input sockets of the two texture nodes.
8. Set the **Voronoi Texture** node's **Coloring** to **Cells** and the **Scale** value to `350.000`. Set the **Noise Texture** node's **Scale** value to `450.000` and **Detail** to `5.000`.
9. Add two **Math** nodes (press *Shift* + *A* and navigate to **Converter** | **Math**). Set the **Operation** of the second node to **Multiply**. Connect the **Fac** output of the **Voronoi Texture** node to the first **Value** input socket of the **Add-Math** node. Connect the **Fac** output of the **Noise Texture** node to the second **Value** input socket of the **Add-Math** node.
10. Connect the **Add-Math** node output to the first **Value** input socket of the **Multiply-Math** node. Set second **Value** to `0.060` and connect the output to the **Displacement** input socket of the **Material Output** node, as shown in the following screenshot:



The slight bump effect added to the network

11. Add a **MixRGB** node (press *Shift* + *A* and navigate to **Color** | **MixRGB**) and move it close to the **Voronoi Texture** node. Set the **Blend Type** to **Multiply**. Connect the **Voronoi Texture** node's **Color** output to the **Color2** input socket of the **Multiply-MixRGB** node. Then connect the **Color** output of this node to the **Color** input sockets of the **Diffuse BSDF**, **Velvet BSDF**, and **Glossy BSDF** shaders.
12. Add an **RGB** node (press *Shift* + *A* and navigate to **Input** | **RGB**) and connect it to the **Color1** input socket of the **Multiply-MixRGB** node, as shown in this screenshot:



The overall view of the network

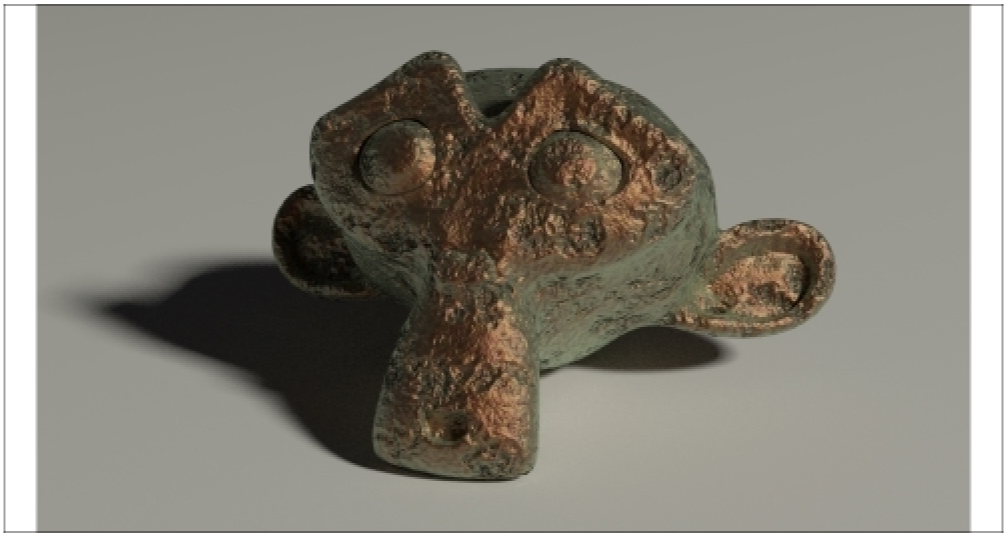
13. Save the file as `Rubber.blend`.

How it works...

We built the shader in steps 1 to 5. We added a slight bump effect in steps 6 to 10. In the last two steps, we just added the **RGB** node, a control used to set the color of the material.

Creating an antique bronze material with procedurals

In this recipe, we will create a bronze shader that looks similar to a ruined, corroded, and antique statue, as shown in the following screenshot:

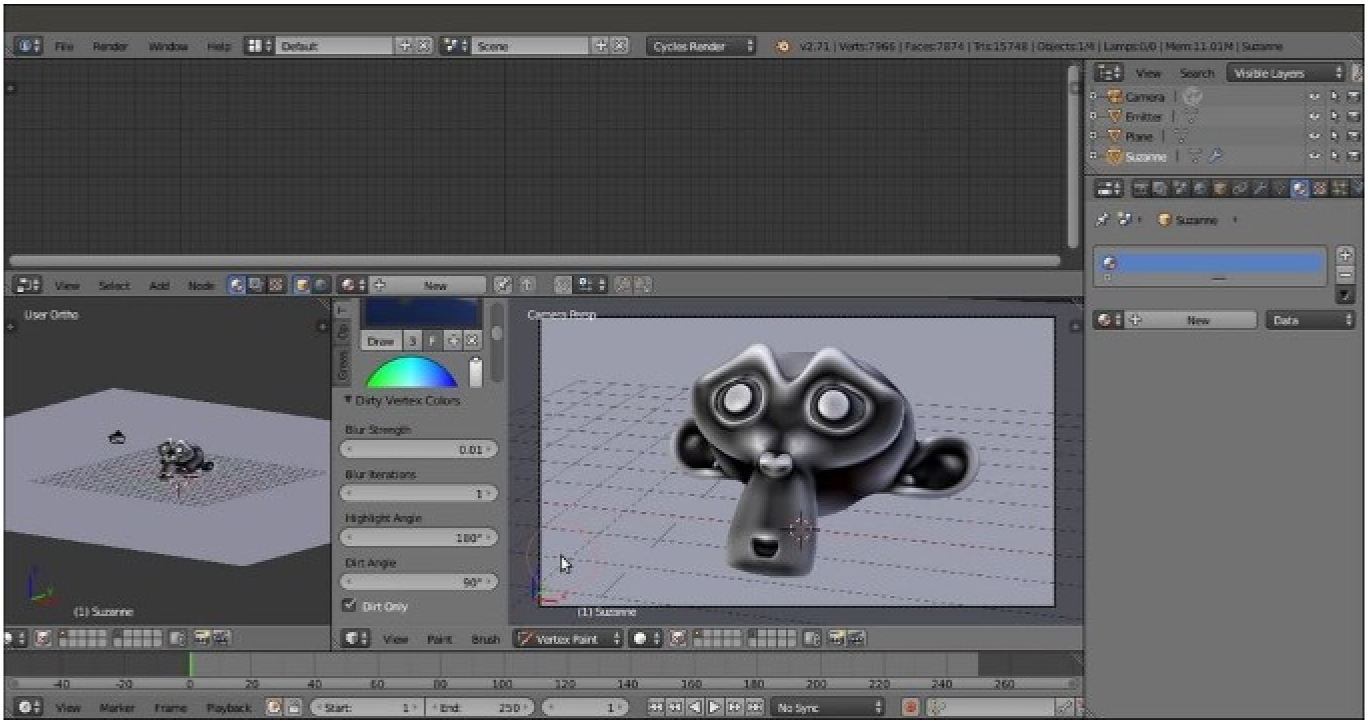


The antique bronze material as it appears in the final rendering when assigned to the poor Suzanne mesh!

Getting ready...

Start Blender and load the `9931OS_Suzanne_start.blend` file. Then perform the following steps:

1. With **Suzanne** selected, click on the **Object Mode** button in the **Camera** view toolbar. Choose **Vertex Paint**.
2. Click on the **Paint** item in the toolbar and select **Dirty Vertex Colors**, the first option at the top. Then press *T*, and in the **Option** panel at the bottom of the **Tool Shelf** panel, set **Blur Strength** to `0.01` and **Dirt Angle** to `90`. Check the **Dirt Only** item, as shown in this screenshot:



▼ Dirty Vertex Colors

Blur Strength 0.01

Blur Iterations 1

Highlight Angle 180°

Dirt Angle 90°

☑ Dirt Only

The Dirty Vertex Colors setting and the effect on the Suzanne mesh

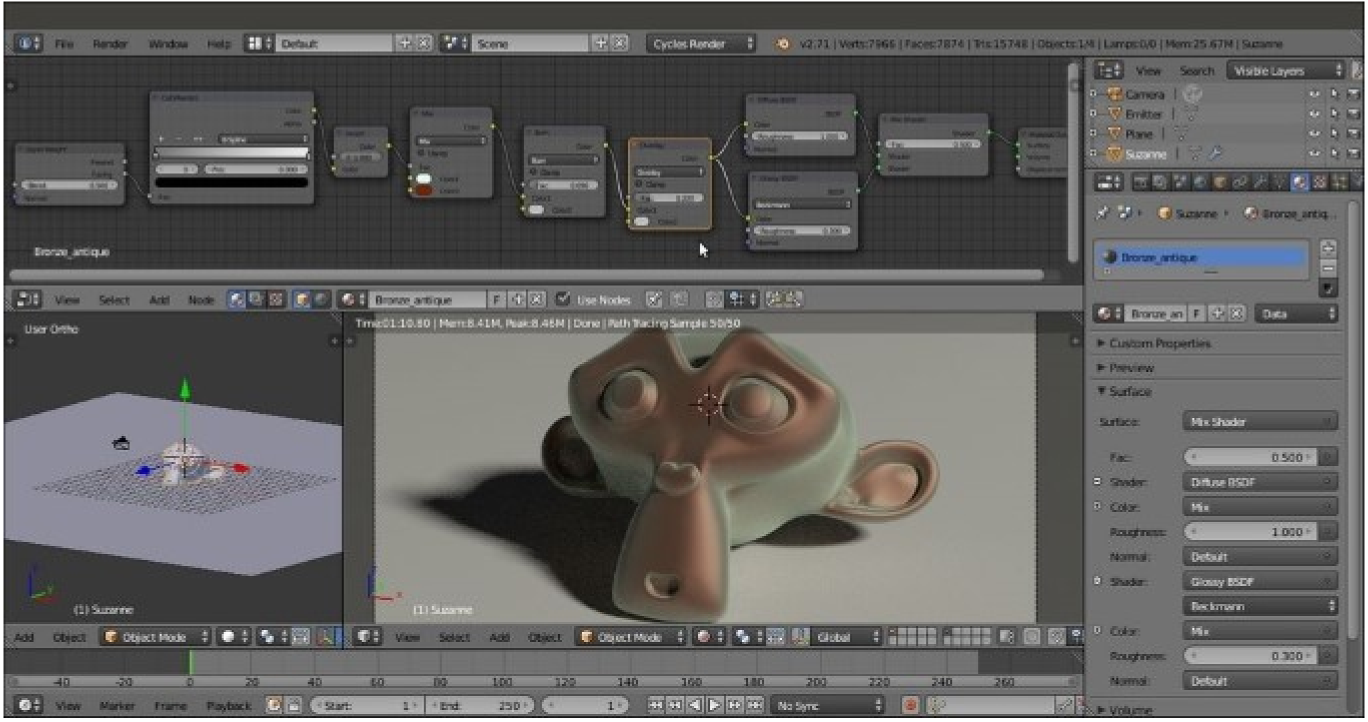
3. Go to the **Object data** window under the **Properties** panel. Double-click on the **Col** item in the **Vertex Colors** subpanel and rename it `V_col`.
4. Return in **Object Mode** and press *T* to close the **Tool Shelf** tabs.
5. Save the file as `9931OS_Suzanne_vcol.blend`. We will use this file for other recipes.

How to do it...

Now we are going to create the material by performing the following steps:

1. First, save the file as `Bronze_antique.blend`.
2. Click on **New** in the **Material** window under the **Properties** panel or in the **Node Editor** toolbar. Rename the material `Bronze_antique`.
3. In the **Material** window, switch the **Diffuse BSDF** shader with a **Mix Shader** node, and in the first **Shader** slot, select a **Diffuse BSDF** shader. In the second **Shader** slot, select a **Glossy BSDF** node. Set the **Diffuse BSDF** shader node's **Roughness** value to `1.000` and the **Glossy BSDF** node's **Roughness** value to `0.300`.
4. Now add a **Layer Weight** node (press *Shift* + *A* and navigate to **Input** | **Layer Weight**), a **ColorRamp** node (press *Shift* + *A* and navigate to **Converter** | **ColorRamp**), and a **MixRGB** node (press *Shift* + *A* and navigate to **Color** | **MixRGB**). In the **Properties** panel of the **Node Editor** window (press *N* to make it appear), label the **ColorRamp** node as `ColorRamp1`. Set its **Interpolation** mode to `B-Spline`.
5. Connect the **Facing** output of the **Layer Weight** node to the **Fac** input of the **ColorRamp1** node, and its **Color** output to the **Fac** input socket of the **MixRGB** node.

6. Set the **Color1** value of the **MixRGB** node as **R** to `0.771`, **G** to `1.000`, and **B** to `0.848`. Set the **Color2** values as **R** to `0.222`, **G** to `0.013`, and **B** to `0.000`.
7. Add an **Invert** node (press *Shift* + *A* and navigate to **Color** | **Invert**). Paste it between the **ColorRamp1** and the **MixRGB** nodes'.
8. Press *Shift* + *D* to duplicate the **MixRGB** node, and set **Blend Type** to **Burn**. Set the **Fac** value to `0.090`. Connect the **Mix-MixRGB** node's **Color** output to the **Color1** input socket of the **Burn-MixRGB** node.
9. Press *Shift* + *D* to duplicate the **MixRGB** node again. Set the **Blend Type** to **Overlay** and the **Fac** value to `0.200`. Connect its **Color** output to both the **Color** input sockets of the **Diffuse BSDF** and **Glossy BSDF** shaders. Now connect the **Color** output of the **Burn-MixRGB** node to the **Color1** input socket of the **Overlay-MixRGB** node, as shown in the following screenshot:



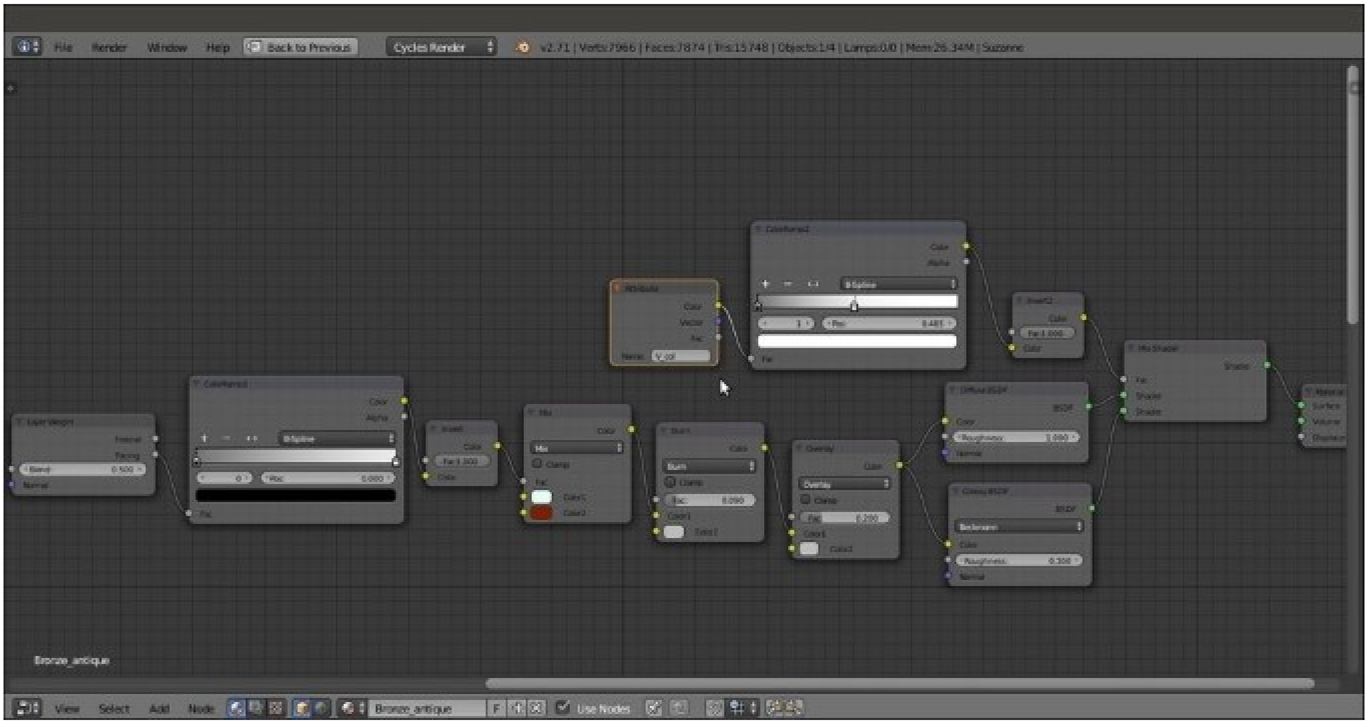
v2.71 | Verts:7966 | Faces:7874 | Tris:15748 | Objects:1/4 | Lamps:0/0 | Mem:25.67M | Suzanne

Time:01:10.80 | Mem:8.41M, Peak:8.46M | Done | Path Tracing Sample 50/50

Surface: Mix Shader
Fac: 0.500
Shader: Diffuse BSDF
Color: Mix
Roughness: 1.000
Normal: Default
Shader: Glossy BSDF
Beckmann
Color: Mix
Roughness: 0.300
Normal: Default

The shader part of the material

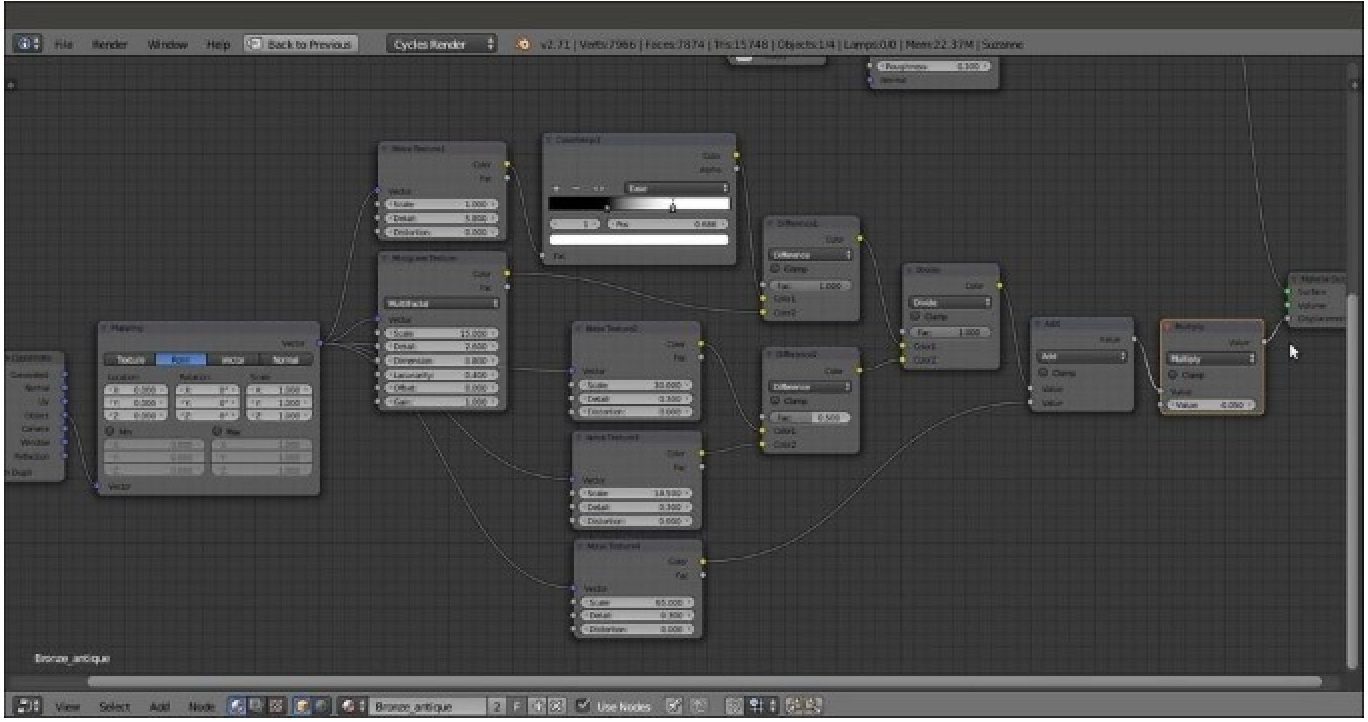
10. Add an **Attribute** node (press *Shift* + *A* and navigate to **Input** | **Attribute**). Select and press *Shift* + *D* to duplicate the **ColorRamp** and the **Invert** nodes. Label them as `ColorRamp2` and `Invert2` , respectively, and move them close to the **Attribute** node.
11. Write the name of the Vertex Color layer, `V_col`, in the **Name** slot of the **Attribute** node. Then connect its **Color** output to the **Fac** input of the **ColorRamp2** node. Move the white color stop to position `0.485`.
12. Connect the **Color** output of the **ColorRamp** node to the Color input of the **Invert2** node, then connect the **Color** output of the **Invert2** node to the **Fac** input socket of the **Mix Shader** node, as shown in the following screenshot:



The shader modulated by the Dirty Vertex Colors output

13. Add a **Texture Coordinate** node (press *Shift* + *A* and navigate to **Input** | **Texture Coordinate**), a **Mapping** node (press *Shift* + *A* and navigate to **Vector** | **Mapping**), four **Noise Texture** nodes (press *Shift* + *A*, navigate to **Textures** | **Noise Texture**, and press *Shift* + *D* to duplicate them), and a **Musgrave Texture** node (press *Shift* + *A* and navigate to **Textures** | **Musgrave Texture**).
14. Label the four **Noise Texture** nodes as `Noise Texture1`, `Noise Texture2`, `Noise Texture3`, and `Noise Texture4`.
15. Connect the **Object** output of the **Texture Coordinate** node to the **Vector** input of the **Mapping** node. Connect the **Vector** output of this node to the **Vector** input sockets of all the five texture nodes.
16. For the **Noise Texture1** node, set **Scale** to `1.000` and **Detail** to `5.800`. For the **Noise Texture2** node, set **Scale** to `30.000` and **Detail** to `0.300`. For the **Noise Texture3** node, set **Scale** to `18.500` and **Detail** to `0.300`. Finally, for the **Noise Texture4** node, set **Scale** to `65.000` and **Detail** to `0.300`.
17. For the **Musgrave Texture** node, set **Type** to **Multifractal**, **Scale** to `15.000`, **Detail** to `2.600`, **Dimension** to `0.800`, and **Lacunarity** to `0.400`.
18. Add a **MixRGB** node (press *Shift* + *A* and navigate to **Color** | **MixRGB**), set **Blend Type** to **Difference**, and label it as `Difference1`. Press *Shift* + *D* to duplicate it. Label the duplicate as `Difference2`.
19. Connect the **Color** output of the **Noise Texture1** node to the **Color1** input socket of the **Difference1** node, and set the **Fac** output of this node to `1.000`. Connect the **Color** output of the **Musgrave Texture** node to the **Color2** input socket of the **Difference1** node.

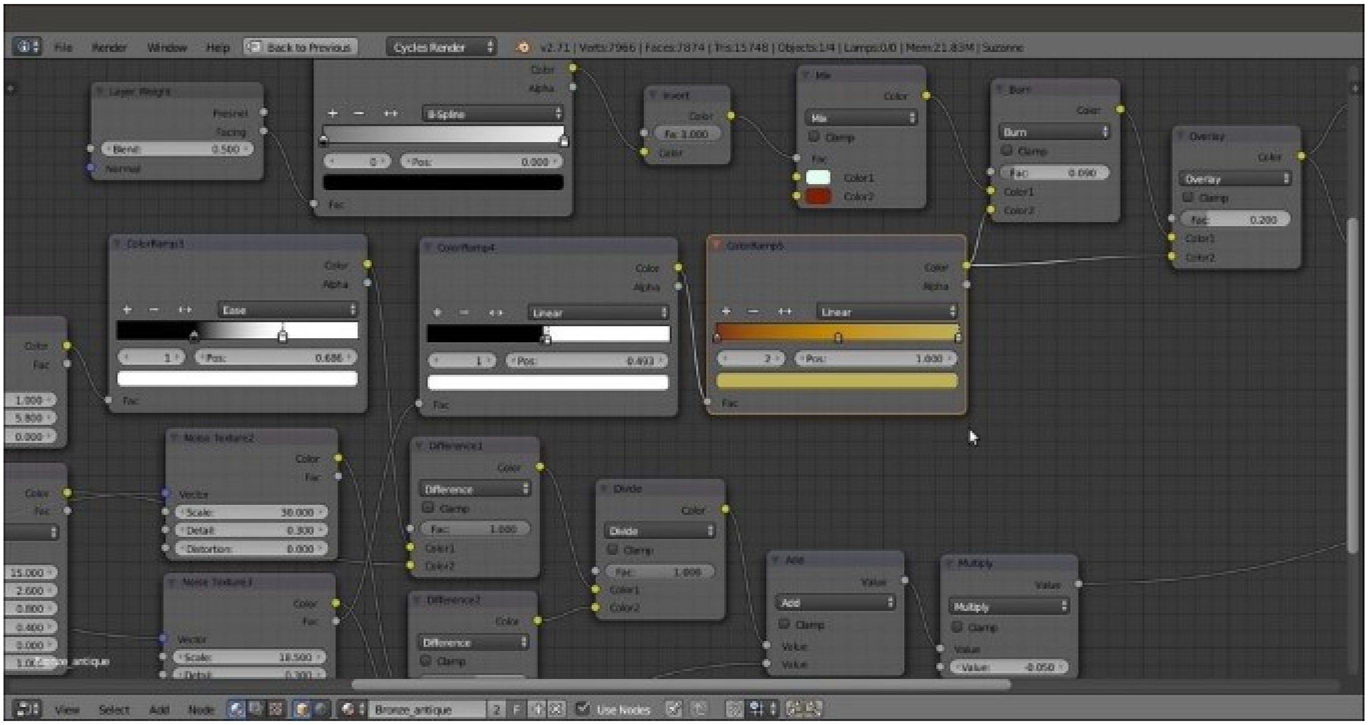
20. Connect the **Color** output of the **Noise Texture2** node to the **Color1** input socket of the **Difference2** node, and the **Color** output of the **Noise Texture3** node to the **Color2** input socket of the **Difference1** node.
21. Press *Shift* + *D* to duplicate the **Difference1** node, and set the **Blend Type** to **Divide**. Connect the **Color** output of the **Difference1** node to the **Color1** input socket of the **Divide** node, and the **Color** output of the **Difference2** node to the **Color2** input socket.
22. Add a **Math** node (press *Shift* + *A* and navigate to **Converter** | **Math**). Connect the output of the **Divide** node to the first **Value** input socket, and the **Color** output of the **Noise Texture4** node to the second **Value** socket.
23. Press *Shift* + *D* to duplicate the **Math** node, and set the **Operation** to **Multiply**. Connect the **Value** output of the **Add-Math** node to the first input socket of the **Multiply-Math** node. Set second **Value** to `-0.050`.
24. Add a **ColorRamp** node (press *Shift* + *A* and navigate to **Converter** | **ColorRamp**), paste it between the **Noise Texture1** node and the **Difference1** node, and label it as `ColorRamp3`. Set **Interpolation** to **Ease**. Move the black color stop to the `0.318` position and the white color stop to the `0.686` position.
25. Connect the output of the **Multiply-Math** node to the **Displacement** input socket of the **Material Output** node, as shown in the following screenshot:



The bump pattern's nodes

26. Add two new **ColorRamp** nodes (press *Shift* + *A* and navigate to **Converter** | **ColorRamp**). Label them as `ColorRamp4` and `ColorRamp5`.
27. Connect the **Fac** output of the **Noise Texture3** node to the **ColorRamp4** node. Set the color black stop to the `0.479` position and the white stop to the `0.493` position.

28. Connect the **Color** output of the **ColorRamp4** node to the **ColorRamp5** node's input socket, and the **Color** output of this node to the **Color2** input sockets of the **Burn** and **Overlay** nodes.
29. Click on the + icon on the **ColorRamp5** node to add a new color stop in the middle of the color slider. Set the black stop color (index `0`) for **R** to `0.216`, **G** to `0.027`, and **B** to `0.007`; the middle stop color (index `1`) for **R** to `0.539`, **G** to `0.261`, and **B** to `0.000`; and the white color stop color (index `2`) for **R** to `0.515`, **G** to `0.433`, and **B** to `0.088`, as shown in the following screenshot:

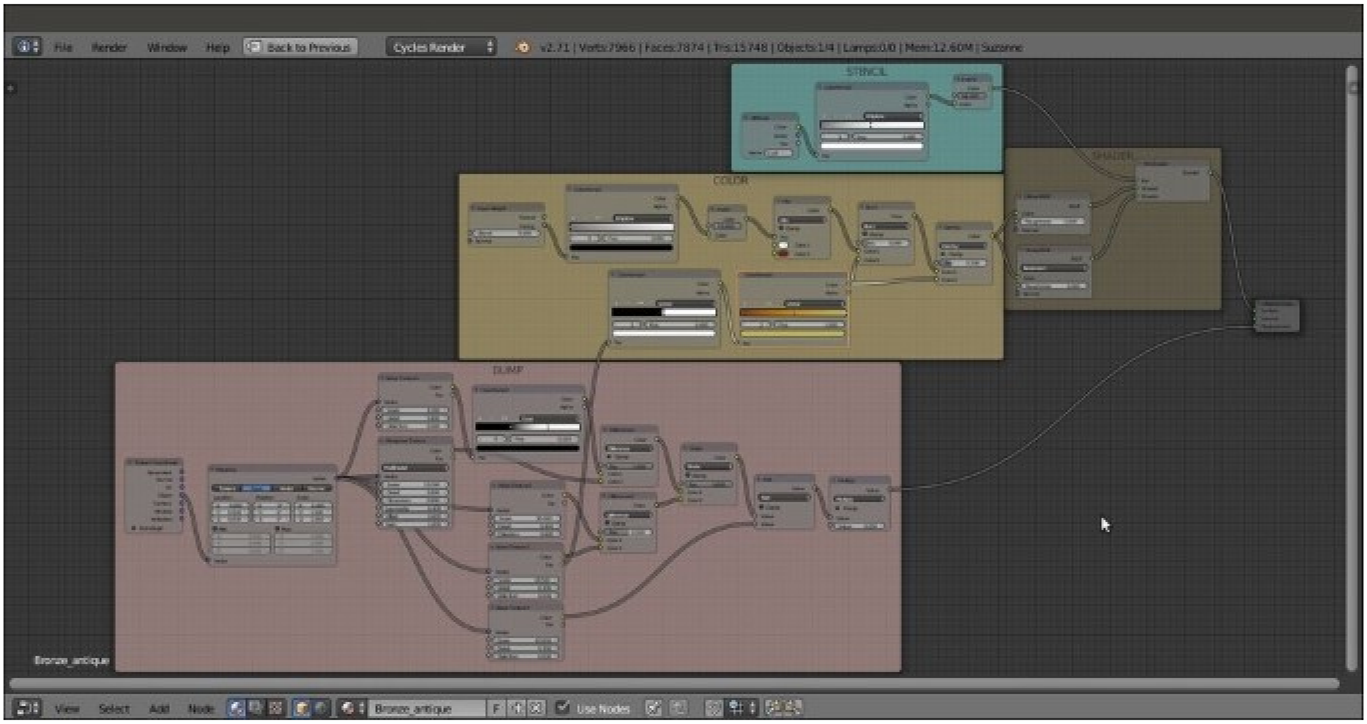


Adding color details to the ground of the bump textures

How it works...

We use the Vertex Color layer set in the *Getting ready* section as a stencil map to distribute both the colored **Diffuse BSDF** and the **Glossy BSDF** shaders, driven by the **Facing** option of the **Layer Weight** input node.

Most of the bump effect is created by the **Noise Texture** and **Musgrave Texture** nodes, which are mixed and clamped in several ways by the **ColorRamp** nodes. Here is a screenshot of the entire material network:



The overall view of the antique bronze material network

As usual, the last **Math** node, which is set to **Multiply**, establishes the strength of the bump.

Creating a multipurpose metal node group

All the metal materials you can see in the following screenshot (pewter, gold, silver, chromium, and aluminum) were obtained from a single shader node group linked and applied to each Suzanne with different interface settings.

To take a look at the scene, open the `9931OS_04_metals.blend` file. In this recipe, we will build the generic **Metal** node group shader. You can find it in the `9931OS_04_metal_group.blend` file, as shown in the following screenshot:

Some examples of different metal materials created by the same node group

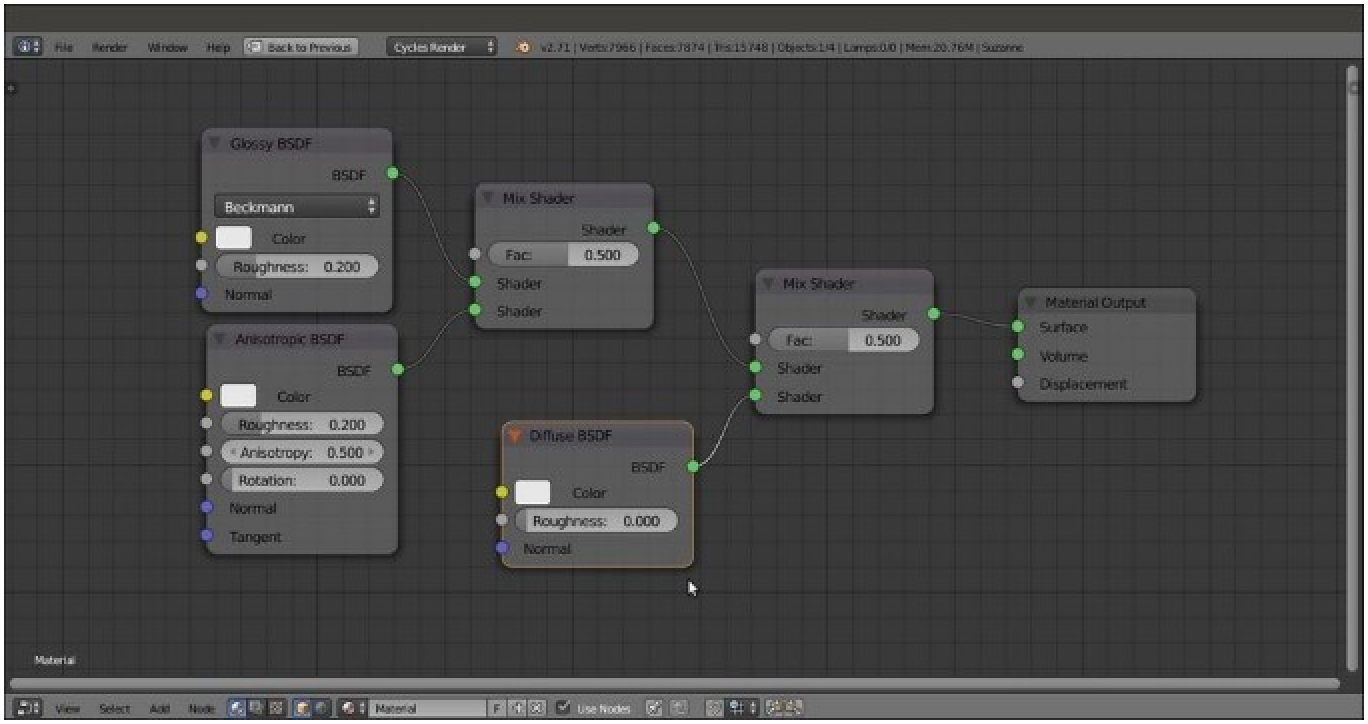
Getting ready...

Start Blender and load the `9931OS_Suzanne_start.blend` file.

How to do it...

Now we are going to create the node group by performing the following steps:

1. Click on **New** in the **Material** window under the **Properties** panel or in the **Node Editor** toolbar.
2. In the **Material** window, switch the **Diffuse BSDF** shader with a **Mix Shader** node, and in the first **Shader** slot, select a **Glossy BSDF** shader. In the second **Shader** slot, select an **Anisotropic BSDF** node.
3. Press *Shift* + *D* to duplicate the **Mix Shader** node, and paste it just after the first **Mix Shader** node. Add a **Diffuse BSDF** shader (press *Shift* + *A* and navigate to **Shader** | **Diffuse BSDF**) and connect it to the second **Shader** input of the second **Mix Shader** node, as shown in the following screenshot:



Glossy BSDF: Beckmann, Roughness: 0.200

Anisotropic BSDF: Roughness: 0.200, Anisotropy: 0.500, Rotation: 0.000

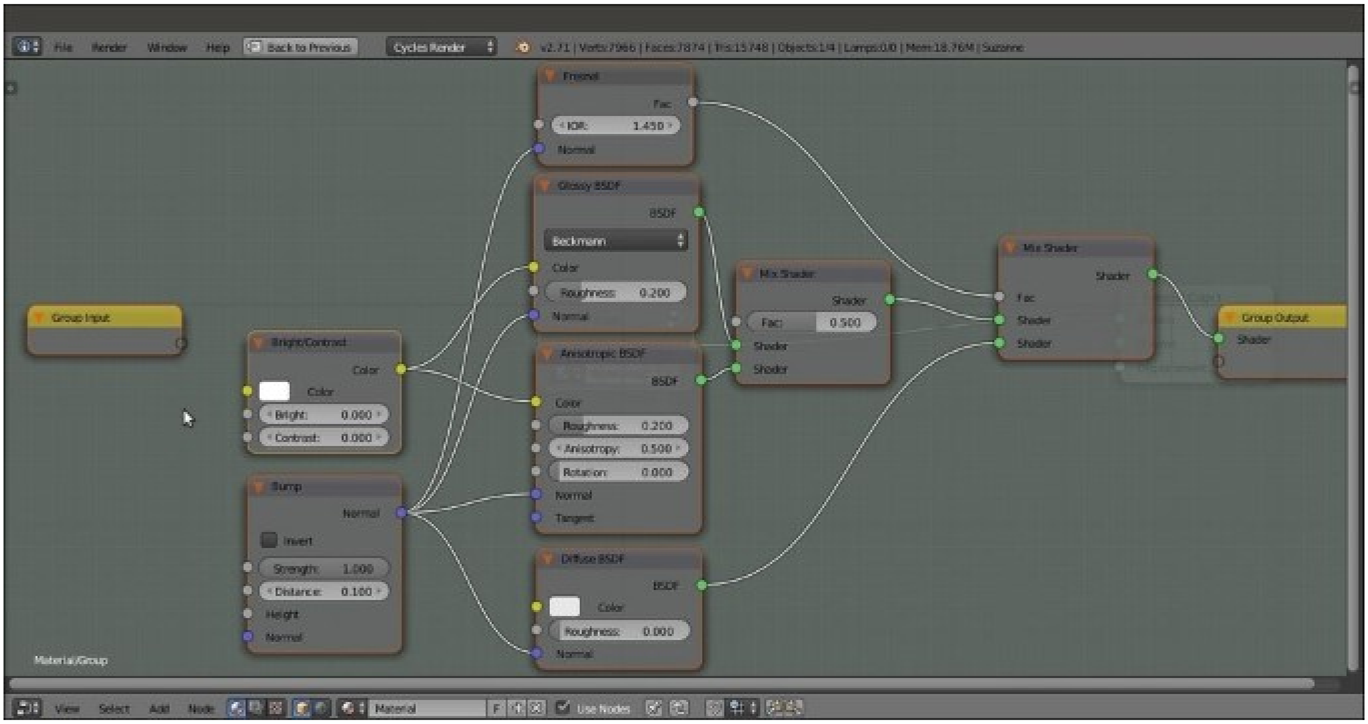
Mix Shader: Fac: 0.500

Mix Shader: Fac: 0.500

Diffuse BSDF: Roughness: 0.000

The basic metal shader network

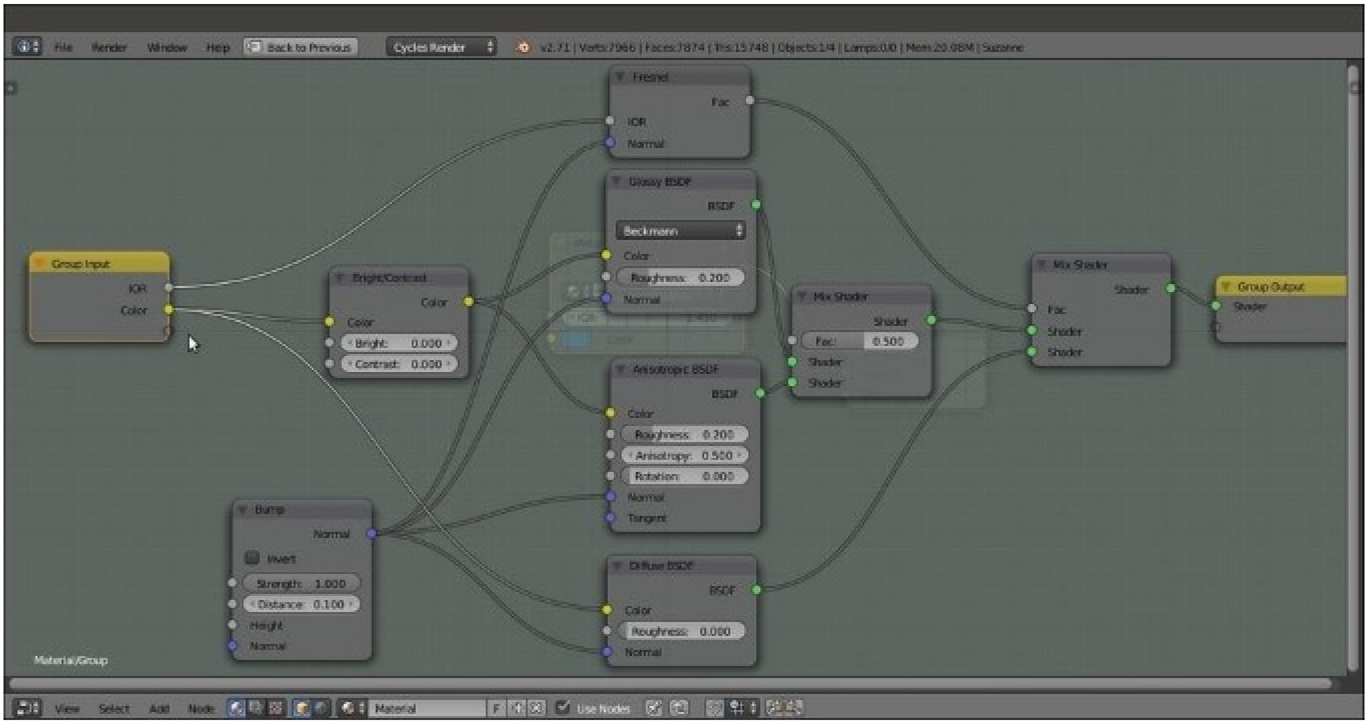
4. Add a **Fresnel** node (press *Shift* + *A* and navigate to **Input** | **Fresnel**) and connect it to the **Fac** input of the second **Mix Shader** node.
5. Add a **Bright Contrast** node (press *Shift* + *A* and navigate to **Color** | **Bright Contrast**). Connect its **Color** output to the **Color** input sockets of the **Glossy BSDF** and **Anisotropic BSDF** shader nodes.
6. Add a **Bump** node (press *Shift* + *A* and navigate to **Vector** | **Bump**). Connect its **Normal** output to the **Normal** input sockets of the **Fresnel**, **Diffuse BSDF**, **Glossy BSDF**, and **Anisotropic BSDF** shader nodes.
7. Select all the nodes except the **Material Output** node, and press *Ctrl* + *G* to create a group, as shown in the following screenshot:



The nodes inside the node group

Now we must expose all the values necessary to tweak the node group for the different types of metal:

1. Click and drag the **IOR** input socket of the **Fresnel** node into the empty socket of the **Group Input** node.
2. Repeat step 1 with the **Color** input socket of the **Diffuse BSDF** shader node. Then drag the **Color** socket of the **Bright/Contrast** node and connect it to the same **Color** socket on the **Group Input** node, as shown in this screenshot:



Roughness: 0.200

Bright: 0.000

Contrast: 0.000

Fac: 0.500

Roughness: 0.200

Anisotropy: 0.500

Rotation: 0.000

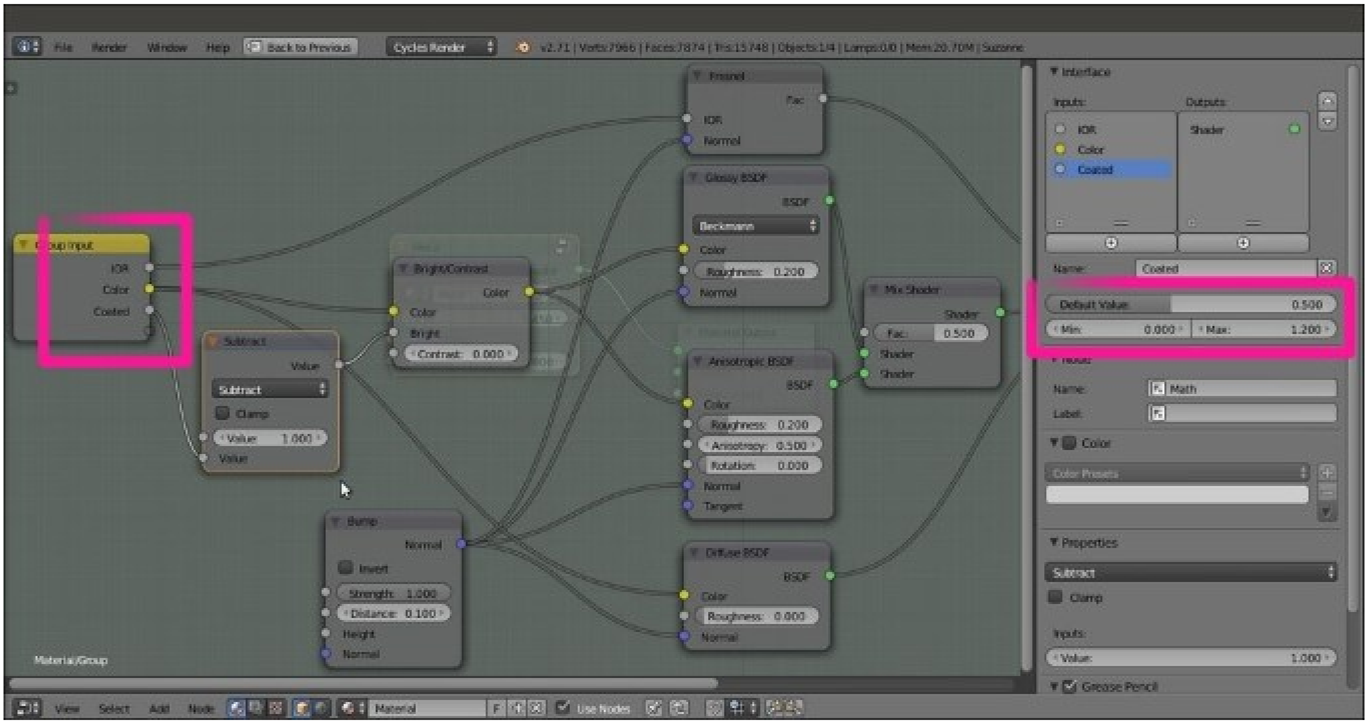
Strength: 1.000

Distance: 0.100

Roughness: 0.000

Creating the exposed sockets

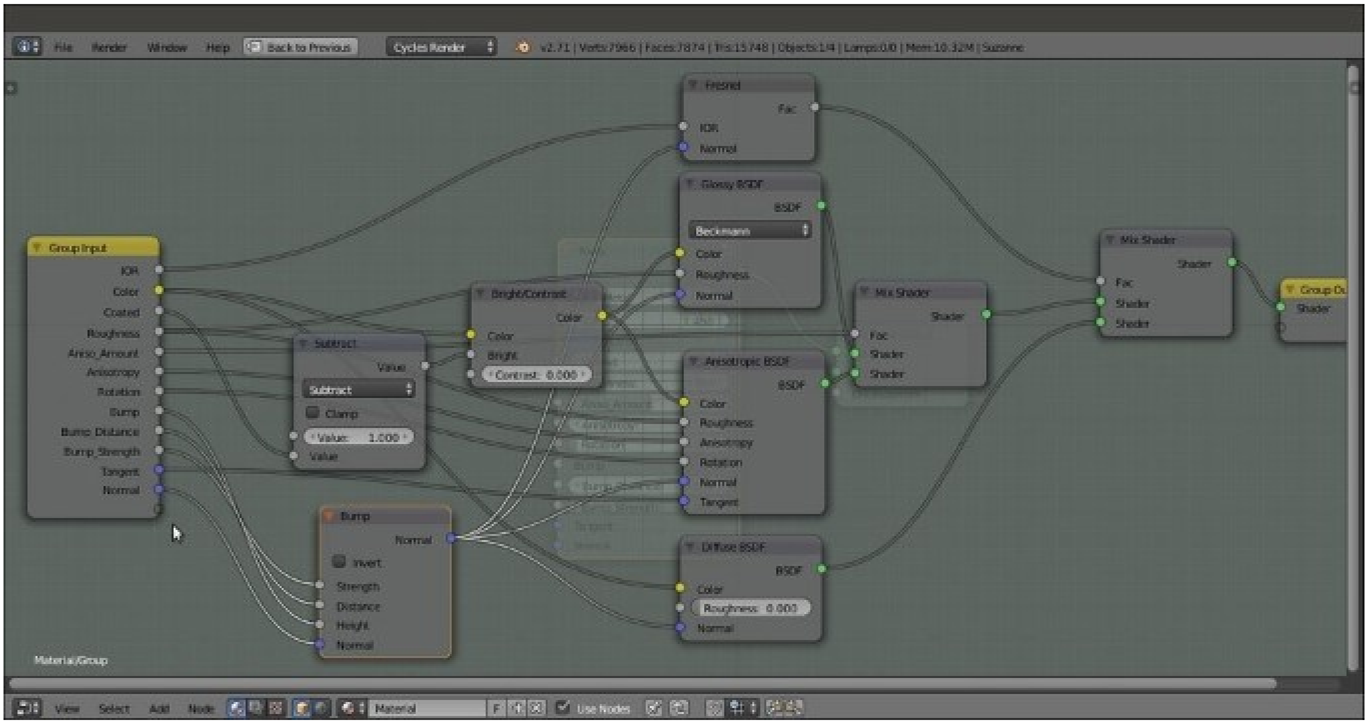
3. Add a **Math** node (press *Shift* + *A* and navigate to **Converter** | **Math**). Set **Operation** to **Subtract** and first **Value** to `1.000`. Drag its second **Value** input socket to the **Group Input** node, label the new socket as `Coated`, and then connect the **Value** output to the **Bright** input socket of the **Bright/Contrast** node. In the **Interface** subpanel under the **Properties** panel, set the **Max** value for the **Coated** socket to `1.200`, as shown in the following screenshot:



Name: Coated
Default Value: 0.500
Min: 0.000
Max: 1.200
Name: Math
Subtract
Value: 1.000
Contrast: 0.000
Roughness: 0.200
Anisotropy: 0.500
Rotation: 0.000
Fac: 0.500
Strength: 1.000
Distance: 0.100
Roughness: 0.000

The setting of the Min and Max values through to the Interface subpanel

4. Drag the **Roughness** input socket of the **Glossy BSDF** shader. Then drag the **Roughness** socket of the **Anisotropic BSDF** shader and connect it to the same socket on the **Group Input** node.
5. Click and drag the **Fac** socket of the first **Mix Shader** node into a new, empty socket. Rename it `Aniso_Amount`. Click and drag the **Anisotropy** socket of the **Anisotropic BSDF** shader node into a new, empty socket. Repeat this step for the **Rotation** input socket.
6. Now click and drag the **Height** socket of the **Bump** node into a new, empty socket. Rename it `Bump`. Repeat this step for the **Distance** and the **Strength** sockets, and rename the sockets `Bump_Distance` and `Bump_Strength`, respectively.
7. Also repeat for the **Normal** socket of the **Bump** node.
8. Finally, click and drag the **Tangent** input socket of the **Anisotropic BSDF** shader.
9. Use the arrows in the top-right corner of the **Interface** subpanel to order the sockets in the **Group Input** node (the same order should be used for the **Group Output** node), as shown in the following screenshot:



The final layout of the completed node group in Edit Mode

10. Exit **Edit Mode** by pressing *Tab*. Rename the group `Metal`. Although this is not "strictly necessary here, you can also click on the **F** icon on the interface to activate the *fake user* for the node group.
11. Save the file as `Metal_group.blend`.

How it works...

The effect of this node group is mainly based on the IOR value (the refractive index of a material is a number that describes how light propagates through that material or gets reflected on its surface). This value can be quite different for each kind of metal. In the node, the exposed **IOR** value drives the amount of blending of the Diffuse component with the Mirror component made by the **Glossy BSDF** and **Anisotropic BSDF** shader nodes combined, but that can also be mutually blended accordingly to the **Aniso_Amount** value.

The **Anisotropy** and **Rotation** values of the **Anisotropic BSDF** shader are exposed as well. and the same for the **Tangent** input if a particular mapping option must be used (for example, a layer of UV coordinates).

Textures must be connected to the **Bump** input socket on the **Bump** node. The **Bump_Strength** socket establishes the amount of bump influence. The **Bump_Distance** socket is a multiplier for the strength of influence. The **Bump** node output is piped to all the **Normal** input of the **Fresnel**, **Diffuse BSDF**, **Glossy BSDF**, and **Anisotropic BSDF** nodes to keep a consistent effect among all the components.

Similarly, both the **Glossy BSDF** and **Anisotropic BSDF** nodes' **Roughness** values are driven by a single-interface input.

Finally, let's discuss the color of the metal. The color that arrives at the **Diffuse BSDF** shader by passing through the **Bright/Contrast** node gets modified by a **Coated** value larger than `0.000`. The result is a different input for the mirror component. The **Subtract-Math** node simply inverts the effect of the numeric input of the **Coated** socket.

Besides the links provided at the end of the previous chapter, for a list of IORs, you can take a look at these links:

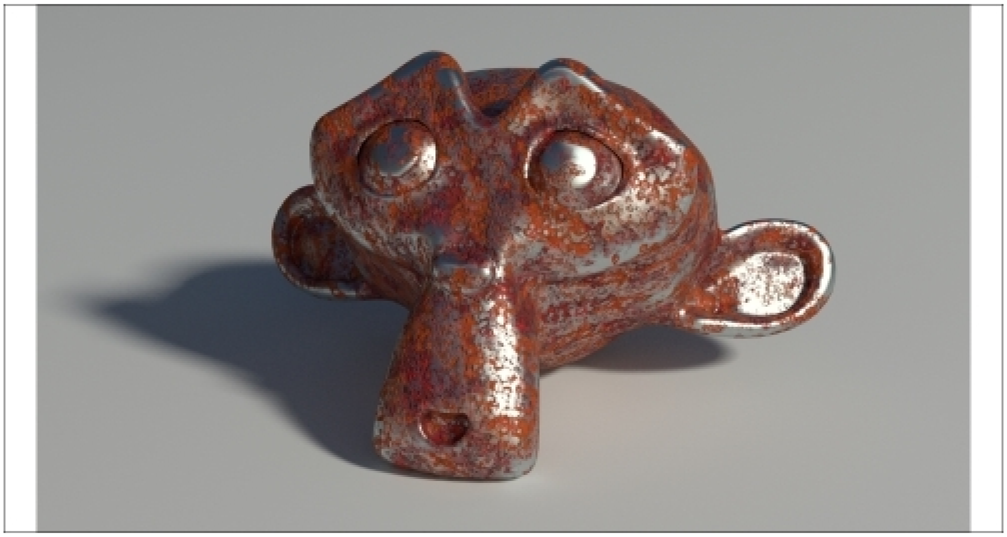
- http://refractiveindex.info/
- http://www.robinwood.com/Catalog/Technical/Gen3DTuts/Gen3DPages/RefractionIndexList.html
- http://forums.cgsociety.org/archive/index.php/t-513458.html

Note

Note that for some materials (especially metals), different lists report different IOR values.

Creating a rusty metal material with procedurals

In this recipe, we will create a rusty shader that will be mixed with the metal shader by a stencil factor, as shown in the following screenshot:



The rusty metal material as it appears in the final rendering

Getting ready...

Start Blender and load the `9931OS_Suzanne_vcol.blend` file. Then perform the following steps:

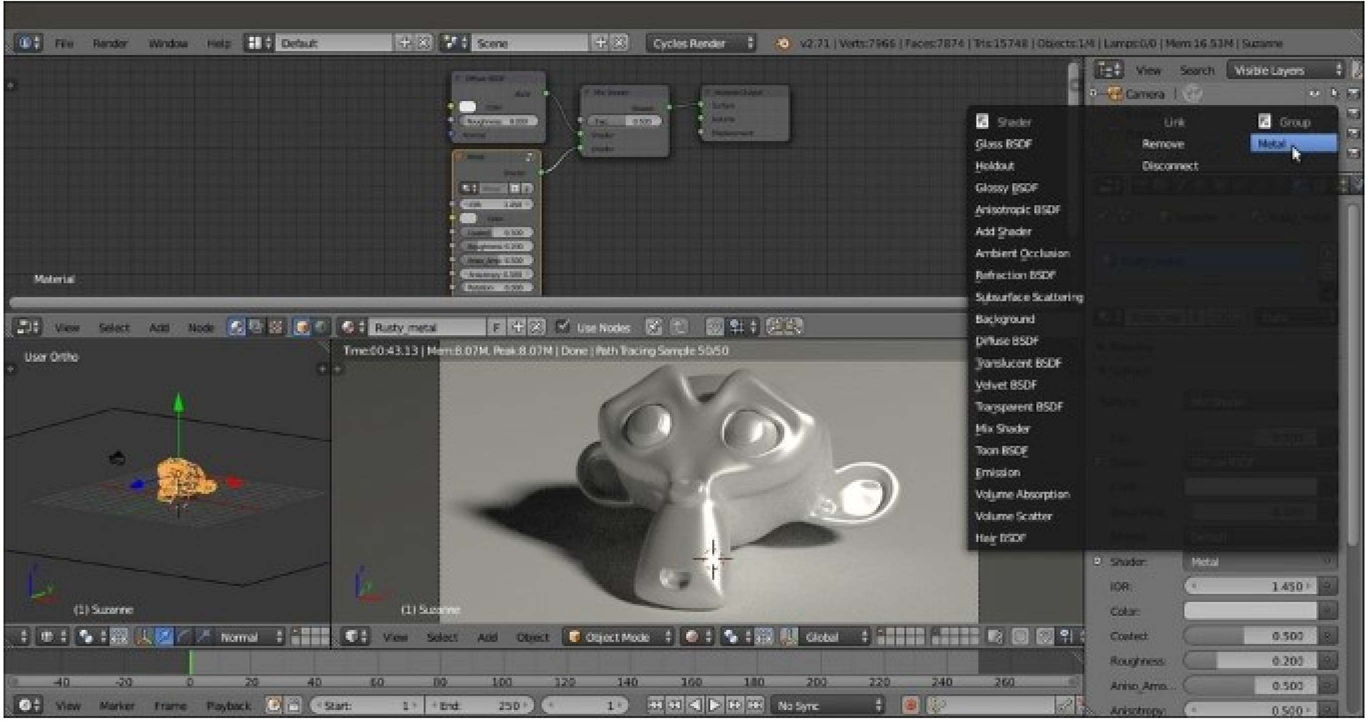
1. Go to the **World** window. Click on the dotted little box to the right of the **Color** slot under the **Surface** subpanel. In the pop-up menu, select the **Environment Texture** item.
2. Click on the **Open** button and browse to the `textures` folder to load the `Barce_Rooftop_C_3K.hdr` image.
3. Set the **Strength** value to `0.200`. Then go back to the **Material** window.

How to do it...

Now we are going to create the shader by performing the following steps:

1. Click on the **File** item in the upper main header. Select the **Link** item. If necessary, browse to the folder where you stored all the blend files. Select the `9931OS_04_metal_group.blend` file. From there, click on the **NodeTree** entry and then select the **Metal** item. Click on the **Link/Append from Library** button to link the node group.
2. Click on **New** in the **Material** window under the **Properties** panel or in the **Node Editor** toolbar. Rename the material `Rusty_metal`.

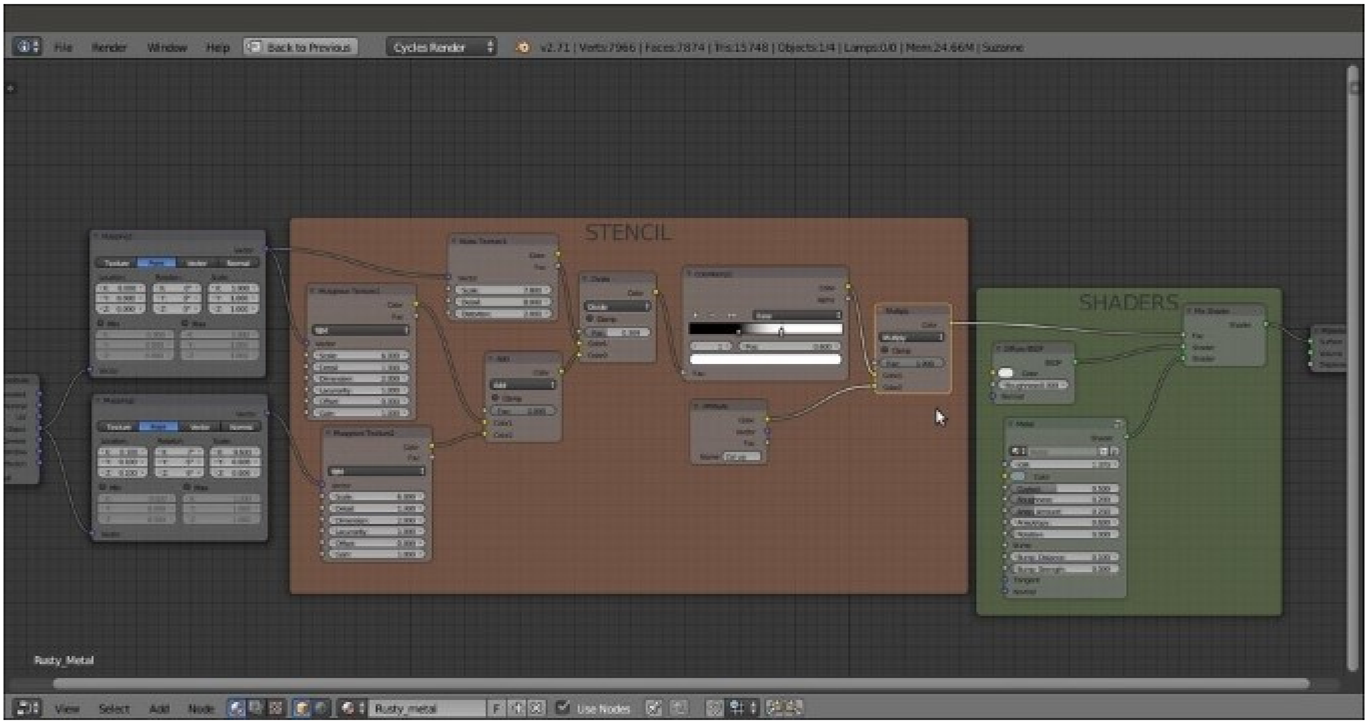
3. In the **Material** window, switch the **Diffuse BSDF** shader with a **Mix Shader** node, and in the first **Shader** slot, select a **Diffuse BSDF** shader. In the second **Shader** slot, under **Group** in the pop-up menu, load the linked **Metal** node group, as shown in the following screenshot:



The Properties pop-up menu used to select different nodes

4. Add **Frame** (press *Shift* + *A* and navigate to **Layout** | **Frame**). Select the **Diffuse BSDF** shader, the **Metal** node group, the **Mix Shader** node, and then the **Frame**. Press *Ctrl* + *P* to parent them. In the **Properties** panel of the **Node Editor** window (press the *N* key to make it appear), label the **Frame** as `SHADERS`.
5. In the **Metal** group, set the **IOR** value to `1.370`. Change the Color values for **R** to `0.229`, **G** to `0.307`, and **B** to `0.299`. Set the **Roughness** value to `0.200`, **Aniso_Amount** to `0.200`, and **Anisotropy** to `0.600`.
6. Add a **Texture Coordinate** node (press *Shift* + *A* and navigate to **Input** | **Texture Coordinate**) and two **Mapping** nodes (press *Shift* + *A* and navigate to **Vector** | **Mapping**). Connect the **Object** output of the **Texture Coordinate** node to the **Vector** input of both the **Mapping** nodes. Label them as `Mapping1` and `Mapping2`.
7. Now add a **Musgrave Texture** node (press *Shift* + *A* and navigate to **Texture** | **Musgrave Texture**) and label it as `Musgrave Texture1`. Add a **Noise Texture** node (press *Shift* + *A* and navigate to **Texture** | **Noise Texture**), label it as `Noise Texture1`, and add a **ColorRamp** node (press *Shift* + *A* and navigate to **Converter** | **ColorRamp**). Label this node as `ColorRamp1`.
8. Set the **Musgrave Texture** node's **Scale** value to `6.000` and **Detail** to `1.300`. Press *Shift* + *D* to duplicate it, and label the duplicate as `Musgrave Texture2`. Set the **Noise Texture** node's **Scale** value to `7.800`, **Detail** to `8.000`, and **Distortion** to `2.000`.

9. Connect the **Vector** output of the **Mapping1** node to the **Vector** input sockets of the **Musgrave Texture1** and **Noise Texture1** nodes. Then connect the **Vector** output of the **Mapping2** node to the **Vector** input sockets of the **Musgrave Texture2** node. In the **Mapping2** node, set the **Location** value to `0.100` and **Scale** to `0.600` for the three axes. Then change the **Rotation** value of **X** to `7` and **Y** to `-5`.
10. Connect the **Fac** output of the **Noise Texture** node to the **Fac** input of the **ColorRamp1** node. Set its **Interpolation** to **Ease**. Move the black color stop to the `0.321` position and the white color stop to the `0.600` position.
11. Add a **MixRGB** node (press *Shift* + *A* and navigate to **Color** | **MixRGB**). Set the **Fac** value to `1.000` and **Blend Type** to **Add**. Then connect the color output of the **Musgrave Texture1** node to the **Color1** input socket and the **Color** output of the **Musgrave Texture2** node to the **Color2** input socket of the **Add-MixRGB** node.
12. Press *Shift* + *D* to duplicate the **Add-MixRGB** node. Set **Blend Type** to **Divide** and the **Fac** value to `0.309`. Connect the **Fac** output of the **Noise Texture1** node to the **Color1** input socket and the output of the **Add-MixRGB** node to the **Color2** input socket of the **Divide-MixRGB** node.
13. Connect the output of the **Divide-MixRGB** node to the **Fac** input socket of the **ColorRamp1** node. Press *Shift* + *D* to duplicate the **Divide-MixRGB** node, and change the **Blend Type** to **Multiply**. Set the **Fac** value to `1.000` and connect the output of the **ColorRamp1** node to the **Color1** input socket.
14. Add an **Attribute** node (press *Shift* + *A* and navigate to **Input** | **Attribute**) and connect its **Color** output to the **Color2** input socket of the **Multiply-MixRGB** node. In its **Name** slot, write the name of the Vertex Color layer, (`Col_vp`).
15. Add **Frame** (press *Shift* + *A* and navigate to **Layout** | **Frame**). Select the **Musgrave Texture** node, the **Noise Texture** node, the **ColorRamp1** node, the three **MixRGB** nodes, the **Attribute** node, and then the **Frame**. Press *Ctrl* + *P* to parent them. Label the frame as `STENCIL`.
16. Connect the output of the **Multiply-MixRGB** node under the **STENCIL** frame to the **Fac** input socket of the **Mix Shader** node under the **SHADERS** frame, as shown in the following screenshot:

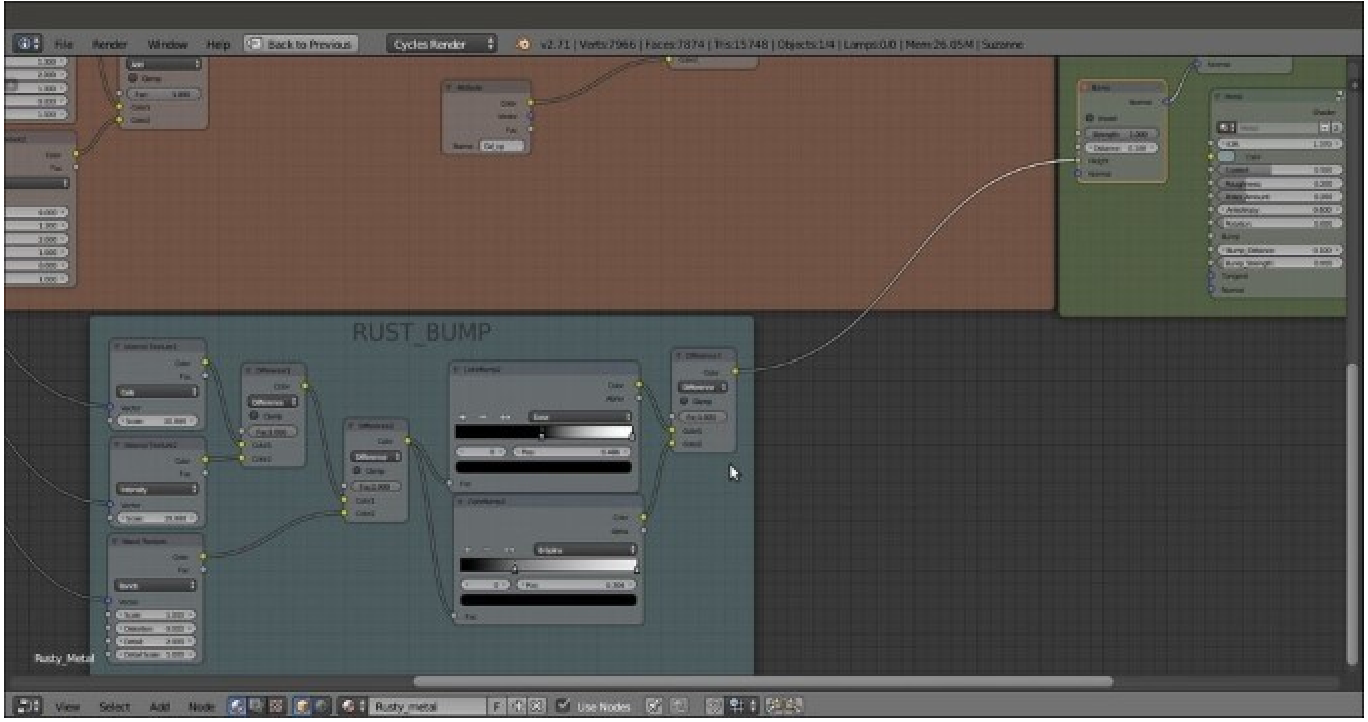


The first two frames of the material, SHADERS and STENCIL

17. Add two **Voronoi Texture** nodes (press *Shift* + *A*, navigate to **Texture** | **Voronoi Texture**, and label them as `Voronoi Texture1` and `Voronoi Texture2`) and a **Wave Texture** node (press *Shift* + *A* and navigate to **Texture** | **Wave Texture**). In the **Voronoi Texture1** node, set the **Coloring** to **Cells** and the **Scale** value to `20.000`. In the **Voronoi Texture2** node, set the **Scale** value to `19.000`. Set the **Wave Texture** node's **Scale** value to `1.000`.
18. Connect the **Vector** output of the **Mapping1** node to the **Vector** input sockets of these three new texture nodes.
19. Add a **MixRGB** node (press *Shift* + *A* and navigate to **Color** | **MixRGB**), set the **Blend Type** to **Difference**, and label it as `Difference1`. Set the **Fac** value to `1.000`. Then connect the **Voronoi Texture1** node's **Color** output to the **Color1** input socket and the second **Voronoi Texture2** node's **Color** output to the **Color2** input socket.
20. Press *Shift* + *D* to duplicate the **Difference1** node, and label the duplicate as `Difference2`. Connect the **Color** output of the **Difference1** node to the **Color1** input socket of the **Difference2** node. Then connect the **Color** output of the **Wave Texture** node to the **Color2** input socket.
21. Add two **ColorRamp** nodes (press *Shift* + *A* and navigate to **Converter** | **ColorRamp**), label them as `ColorRamp2` and `ColorRamp3`, and connect the output of the **Difference2** node to their **Fac** input socket. Set the **ColorRamp2** node's **Interpolation** to **Ease** and move the black color stop to the `0.486` position. Set the **ColorRamp3** node's **Interpolation** to **B-Spline** and move the black color stop to the `0.304` position.
22. Press *Shift* + *D* to duplicate the **Difference2** node, and label the duplicate as `Difference3`. Place it after the **ColorRamp2** node and **ColorRamp3** nodes. Connect the **ColorRamp2** node's

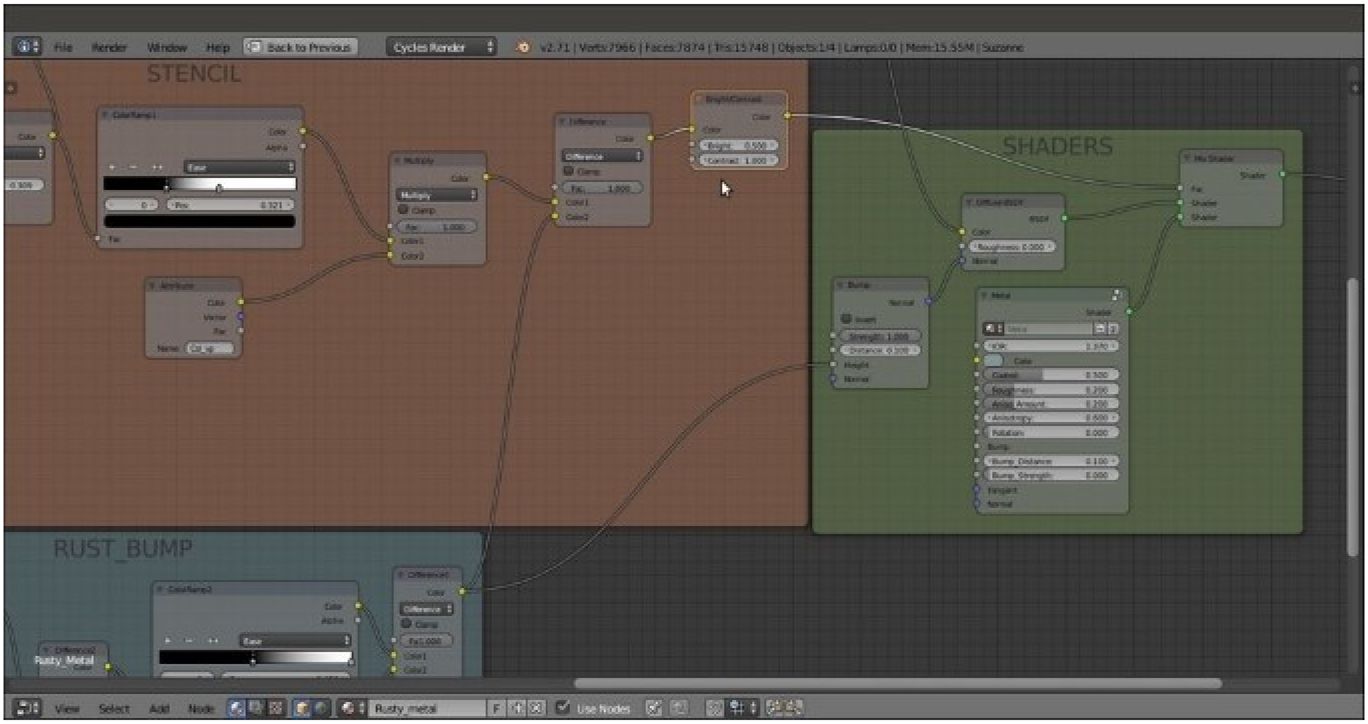
Color output to the **Color1** input socket and the **ColorRamp3** node's **Color** output to the **Color2** input socket of the **Difference3** node.

23. Add **Frame** (press *Shift* + *A* and navigate to **Layout** | **Frame**). Select these lastly added nodes and then the **Frame**. Press *Ctrl* + *P* to parent them. Rename the frame `RUST_BUMP`.
24. Select the **SHADERS** frame and add a **Bump** node (press *Shift* + *A* and navigate to **Vector** | **Bump**). Connect the **Difference3** node's output to the **Height** input socket of the **Bump** node. Connect the **Normal** output of this node to the **Normal** input socket of the **Diffuse BSDF** node inside the **SHADERS** frame, as shown in the following screenshot:



The frame for the bump of the rust

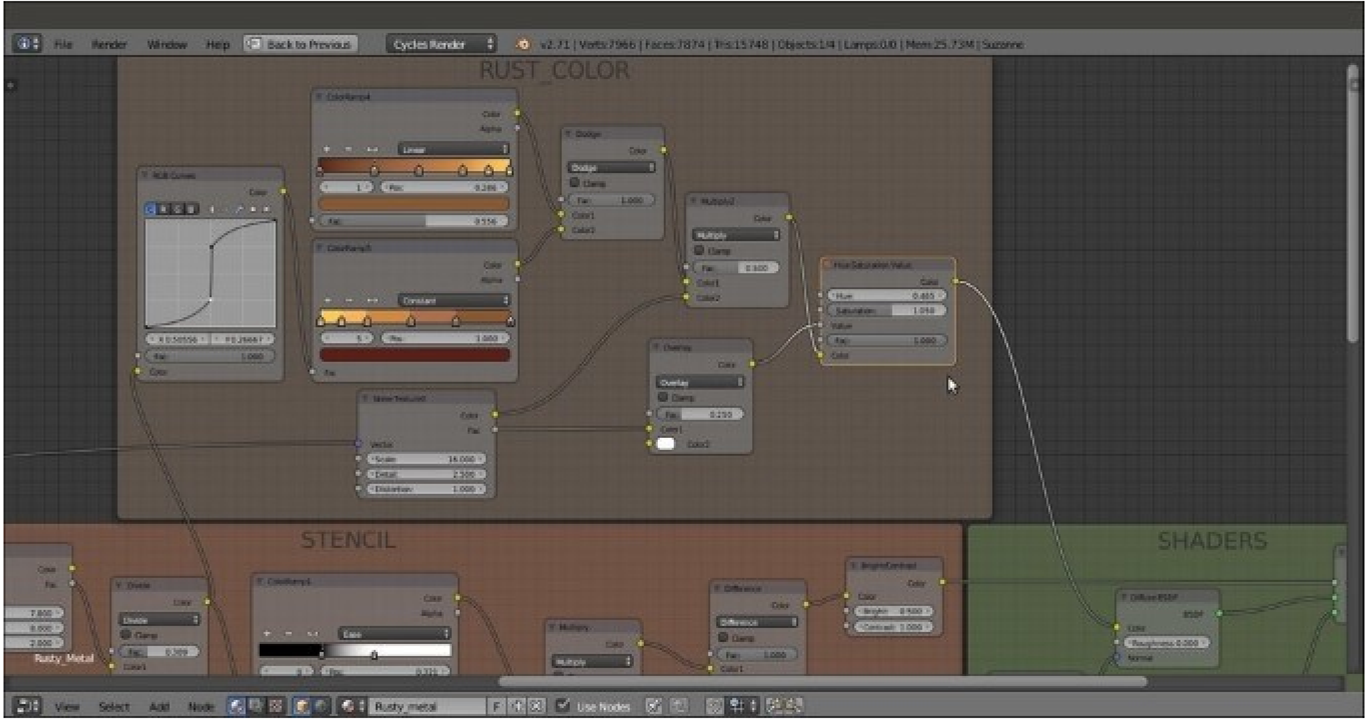
25. Select the **STENCIL** frame and add a **MixRGB** node (press *Shift* + *A* and navigate to **Color** | **MixRGB**) and a **Bright/Contrast** node (press *Shift* + *A* and navigate to **Color** | **Bright Contrast**). Paste the **MixRGB** node right after the **Multiply-MixRGB** node. Set **Blend Type** to **Difference** and then connect the output of the **Difference3** node inside the **RUST_BUMP** frame to the **Color2** input socket. Paste the **Bright/Contrast** node right after this last **Difference** node. Set the **Bright** value to `0.500` and the **Contrast** value to `1.000`, as shown in the following screenshot:



The RUST_BUMP output added to the stencil to separate the metal surface from the rusty surface

26. Add an **RGB Curves** node (press *Shift* + *A* and navigate to **Color** | **RGB Curves**), two **ColorRamp** nodes (press *Shift* + *A*, navigate to **Converter** | **ColorRamp**, and label them as `ColorRamp4` and `ColorRamp5`), a **Noise Texture** node (press *Shift* + *A*, navigate to **Texture** | **Noise Texture**, and label it as `Noise Texture2`), and a **MixRGB** node (press *Shift* + *A* and navigate to **Color** | **MixRGB**).
27. In the **RGB Curves** node's interface, click on the diagonal line to add a control point. In the **X** and **Y** slots at the bottom, set the values to `0.50000` and `0.26000`, respectively. Click again to add a new control point, and set **X** to `0.51000` and **Y** to `0.75000`.
28. Connect the **Color** output of the **RGB Curves** node to the **Fac** input of the **ColorRamp5** node.
29. Go to the **ColorRamp4** node. Select the black color stop and change the color values of **R** to `0.991`, **G** to `0.591`, and **B** to `0.084`. Select the white color stop and change the color values of **R** to `0.105`, **G** to `0.013`, and **B** to `0.010`.
30. Click four times on the **+** icon on the **ColorRamp4** node interface to add four new color stops. Select **4** as the index number and move it to the `0.889` position. Change the color values of **R** to `0.930`, **G** to `0.456`, and **B** to `0.105`. For index **3**, set **Pos** to `0.754`, **R** to `0.624`, **G** to `0.250`, and **B** to `0.053`. For index **2**, set **Pos** to `0.521`, **R** to `0.418`, **G** to `0.159`, and **B** to `0.068`. Finally, for index **1**, set **Pos** to `0.286`, **R** to `0.246`, **G** to `0.098`, and **B** to `0.034`.
31. With the mouse arrow inside the colorband on the **ColorRamp4** node, press *Ctrl* + *C* to copy it. Move the mouse arrow to the colorband of the **ColorRamp5** node. Press *Ctrl* + *V* to paste the colors and the stops. Set the **ColorRamp5** node's **Interpolation** to **Constant**.

32. Connect the **Color** output of both the **ColorRamp4** and **ColorRamp5** nodes to the **Color1** and **Color2** input sockets of the **MixRGB** node, respectively. Set the **MixRGB** node's **Blend Type** to **Dodge** and the **Fac** value to `1.000`.
33. Press *Shift* + *D* to duplicate the **Dodge-MixRGB** node, set the **Blend Type** to **Multiply**, and label it as `Multiply2`. Lower the **Fac** value to `0.500`. Connect the **Dodge-MixRGB** node's output to the **Color1** input of the **Multiply2** node and the **Color** output of the **Noise Texture2** node to the **Color2** input.
34. Set the **Noise Texture2** node's **Scale** value to `16.000`, **Detail** to `2.500`, and **Distortion** to `1.000`. Connect the **Object** output of the **Mapping1** node to the **Vector** input of the **Noise Texture2** node.
35. Add a **Hue Saturation Value** node (press *Shift* + *A* and navigate to **Color** | **Hue Saturation Value**). Place it right after the **Multiply2** node. Connect the **Multiply2** output to the **Color** input socket of the **Hue Saturation Value** node. Then set the **Hue** value to `0.465` and the **Saturation** value to `1.050`.
36. Press *Shift* + *D* to duplicate the **Multiply2** node, and place the duplicate close to the **Noise Texture2** node. Set the **Blend Type** to **Overlay** and the **Fac** value to `0.250`. Connect the **Fac** output of the **Noise Texture2** node to the **Color1** input socket of the **Overlay-MixRGB** node, and change **Color2** to pure white. Connect the **Overlay-MixRGB** node's output to the **Value** input socket of the **Hue Saturation Value** node.
37. Add **Frame** (press *Shift* + *A* and navigate to **Layout** | **Frame**). Select these recently added nodes and then the **Frame**. Press *Ctrl* + *P* to parent them. Rename the frame `RUST_COLOR`.
38. Connect the output of the **Hue Saturation Value** node inside the **RUST_COLOR** frame to the **Color** input socket of the **Diffuse BSDF** shader node inside the **SHADERS** frame. Then connect the **Color** output of the **Divide** node inside the **STENCIL** frame to the **Color** input of the **RGB Curves** node inside the **RUST_COLOR** frame, as shown in the following screenshot:



The color of the rusty surface added to the network

39. Save the file as `Metal_rusty.blend`.

How it works...

From step 2 to step 4, we built the basic shader arrangement. From step 6 to step 15, we made the **STENCIL** frame to separate the rust material from the polished metal.

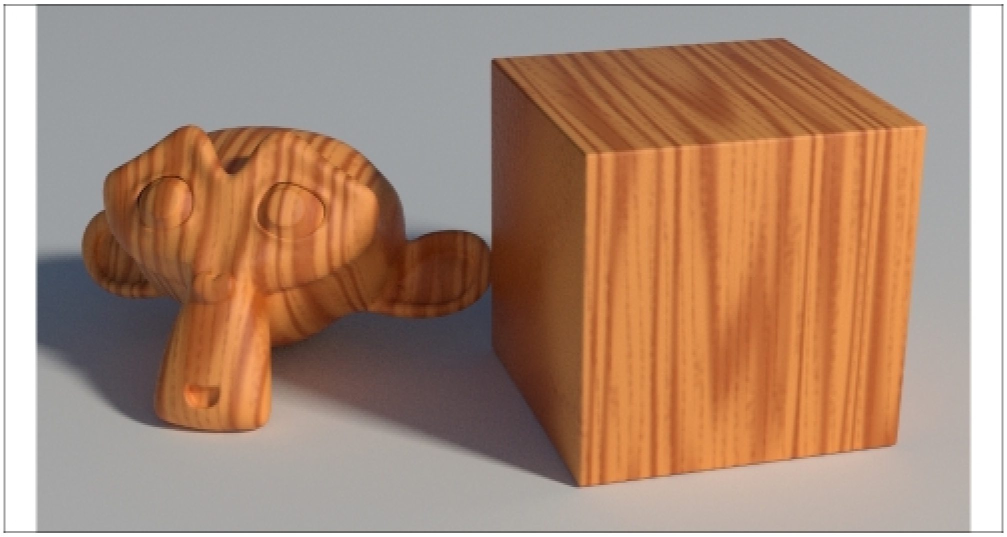
From step 17 to step 23, we built the bump effect for the rust, and from step 26 to step 37, we added the rust color.

There's more...

We used the **Dirty Vertex Colors** layer named `Col_vp` again, this time to give a denser pattern to certain areas of Suzanne compared to other areas. Remember that a Vertex Colors layer can be modified and improved by manual vertex painting on the mesh in **Vertex Paint** mode. We can also use a gray-scale image map, painted in GIMP or in Blender itself and then UV-mapped on the mesh to obtain more precise and localized effects.

Creating a wood material with procedurals

In this recipe, we will create a generic wood material—a shader that can be easily adapted to different situations—as shown in the following screenshot:

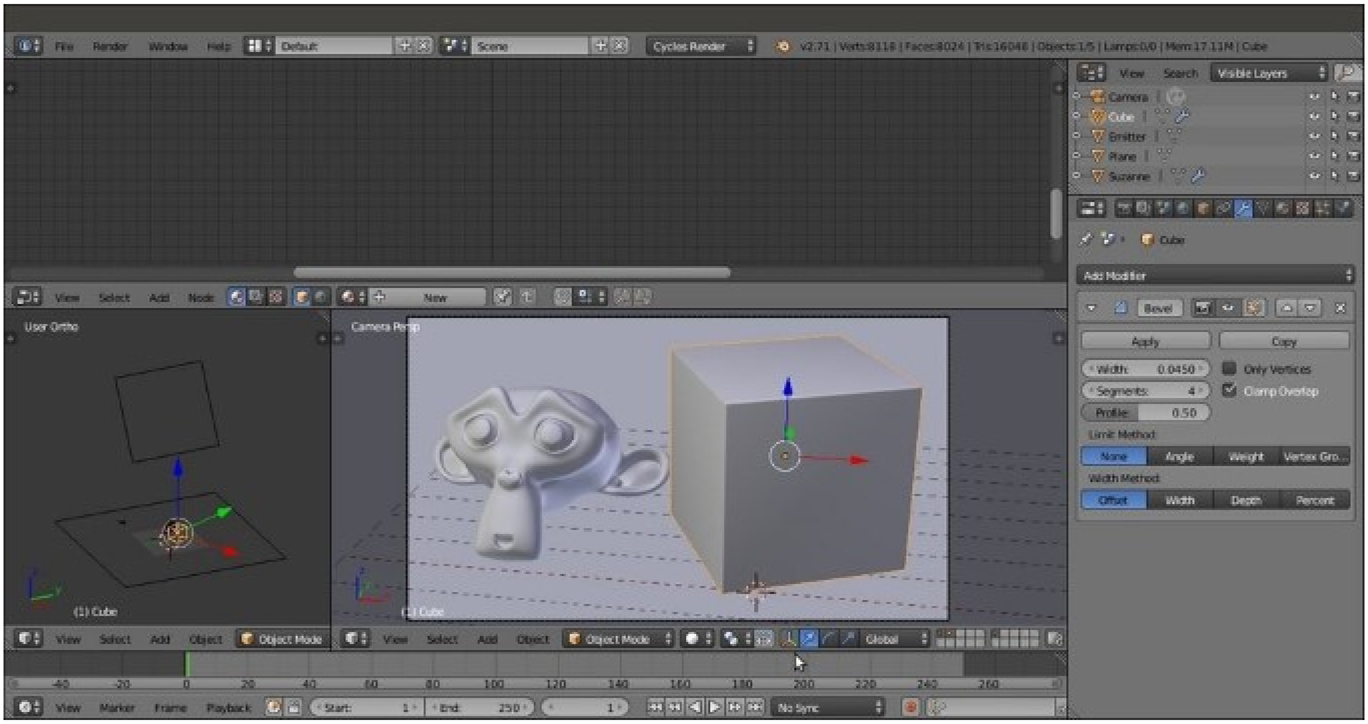


The procedural wood material as it appears in the final rendering

Getting ready...

Start Blender and load the `9931OS_Suzanne_start.blend` file. Then perform these steps:

1. Go to the **World** window and click on the button with a dot icon to the right of the **Color** slot under the **Surface** subpanel. In the pop-up menu, select the **Environment Texture** item.
2. Click on the **Open** button and browse to the `textures` folder to load the `Barce_Rooftop_C_3K.hdr` image.
3. Set the **Strength** value to `0.300`. Then go back to the **Material** window.
4. Go to the **Camera** view and add a **Cube** primitive to the scene. Place it leaning on the Plane, to the right of Suzanne. Move it up by 1 Blender unit.
5. With the mouse arrow in the **Camera** view, press *Shift* + *F* to enter **Walk Mode**. Adjust the Camera position to center the two objects in the frame.
6. Select the **Cube**, go to **Edit Mode**, and scale it to at least twice its current size. Exit **Edit Mode**, and using the 3D manipulator widget (which can be enabled in the 3D view toolbar), move the Cube upwards to stay nicely on the Plane. Press *N*, and in the **Properties** panel, select the **Lock Camera to View** item. Then adjust the Camera position framing the two objects.
7. Assign a **Bevel** modifier to the Cube, set **Width** to `0.0450`, and set the **Segments** value to `4`.
8. Press *T* to call the **Tool Shelf** panel. Set the Cube shading to **Smooth**.
9. Select **Suzanne** and rotate it a bit towards the left on the *z* axis.
10. Press *T* to close the **Tool Shelf** panel.



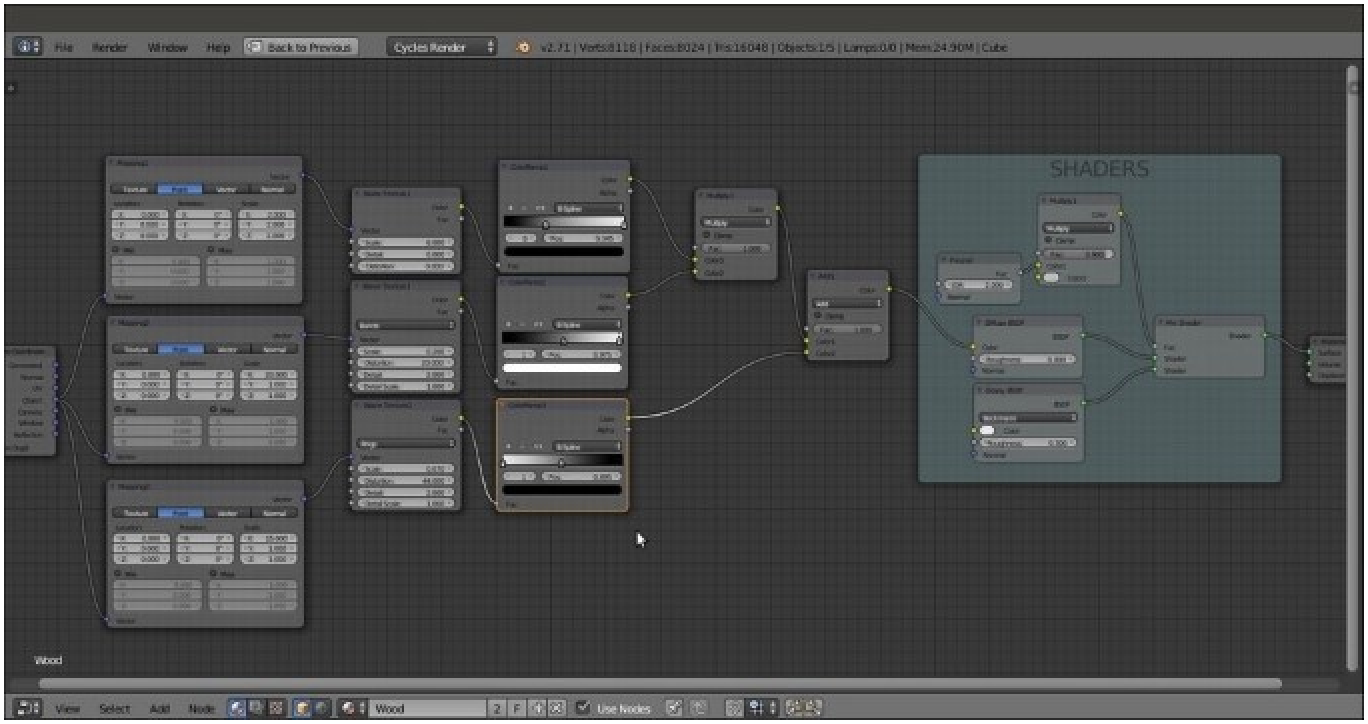
Setting up the scene

How to do it...

Now we are going to create the material by performing the following steps:

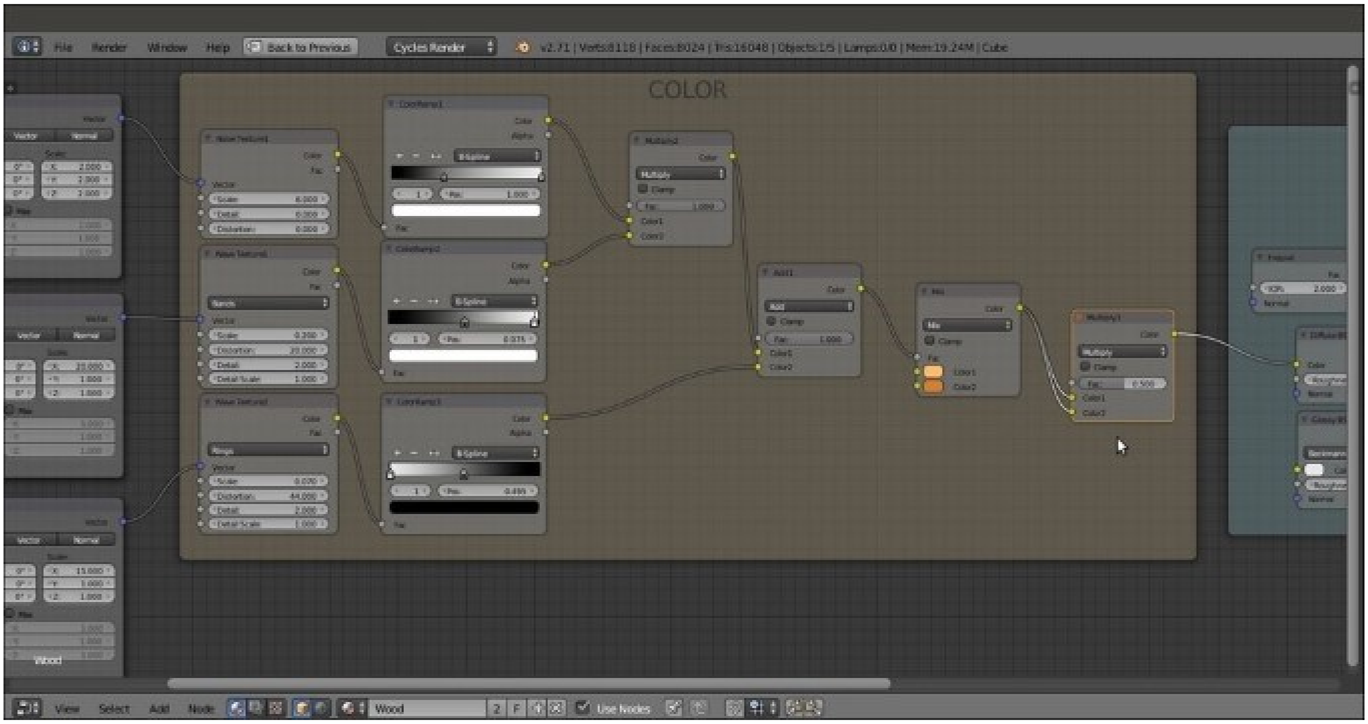
1. Click on **New** in the **Material** window under the **Properties** panel or in the **Node Editor** toolbar. Rename the material `Wood`.
2. Switch the **Diffuse BSDF** shader with a **Mix Shader** node, and in the first **Shader** slot, select a **Diffuse BSDF** shader. In the second **Shader** slot, select a **Glossy BSDF** node. Set the **Glossy BSDF** node's **Roughness** value to `0.300`.
3. Add a **Fresnel** node (press *Shift* + *A* and navigate to **Input** | **Fresnel**) and a **MixRGB** node (press *Shift* + *A* and navigate to **Color** | **MixRGB**). Set the **IOR** value of the **Fresnel** node to `2.000`. Connect its output to the **Color1** input socket of the **MixRGB** node. Set the **MixRGB** node's **Blend Type** to **Multiply**, label it as `Multiply1`, and set the **Fac** value to `0.900`. Connect the **Multiply1** node's output to the **Fac** input socket of the **Mix Shader** node.
4. Add **Frame** (press *Shift* + *A* and navigate to **Layout** | **Frame**). Select the **Diffuse BSDF**, **Glossy BSDF**, **Mix Shader**, **Multiply1**, and **Fresnel** nodes. Then select the **Frame** and press *Ctrl* + *P* to parent them. Label the frame as `SHADERS`.
5. Add one **Texture Coordinate** node (press *Shift* + *A* and navigate to **Input** | **Texture Coordinate**) and three **Mapping** nodes (press *Shift* + *A*; navigate to **Vector** | **Mapping**; add the first node; duplicate the other nodes; and then label them as `Mapping1`, `Mapping2`, and `Mapping3`). Connect the **Object** output of the **Texture Coordinate** node to the **Vector** input of the three **Mapping** nodes.

6. Set the **Scale** value of the **Mapping1** node to `2.000` for all the three axes. Set the **Scale** value only for the *x* axis of the **Mapping2** node to `20.000`. Then set the **Scale** value only for the *x* axis of the **Mapping3** node to `15.000`.
7. Add a **Noise Texture** node (press *Shift* + *A* and navigate to **Texture** | **Noise Texture**) and two **Wave Texture** nodes (press *Shift* + *A* and navigate to **Texture** | **Wave Texture**). Label them as `Noise Texture1`, `Wave Texture1`, and `Wave Texture2`.
8. Set the **Scale** of the `Noise Texture1` node to `6.000` and **Detail** to `0.000`. Connect the **Mapping1** node's output to the **Noise Texture** node's **Vector** input socket.
9. Connect the **Mapping2** node's output to the **Vector** input of the **Wave Texture1** node. Set the **Wave Texture1** node's **Scale** value to `0.200` and **Distortion** to `20.000`.
10. Connect the **Mapping3** node output to the **Wave Texture2** node's **Vector** input socket. Set **Wave Type** to **Rings**, the **Scale** value to `0.070`, and the **Distortion** value to `44.000`.
11. Add a **MixRGB** node (press *Shift* + *A* and navigate to **Color** | **MixRGB**). Set the **Blend Type** to **Multiply** (label it as `Multiply1`) and the **Fac** value to `1.000`. Connect the **Noise Texture** node's **Color** output to the **Color1** input socket and the **Wave Texture1** node's **Color** output to the **Color2** input socket.
12. Connect the **Multiply1** node's output to the **Color** input of the **Diffuse BSDF** shader. Press *Shift* + *D* to duplicate it, change the **Blend Type** to **Add**, and paste it between the **Multiply1** node and the **Diffuse BSDF** shader node. Connect the **Wave Texture2** node's **Color** output to the **Color2** input socket of this **Add-MixRGB** node (labelled as `Add1`).
13. Add a **ColorRamp** node (press *Shift* + *A* and navigate to **Converter** | **ColorRamp**), label it as `ColorRamp1`, and paste it right after the **Noise Texture1** node. Set **Interpolation** to **B-Spline** and move the black color stop to the `0.345` position.
14. Press *Shift* + *D* to duplicate the **ColorRamp1** node, paste it right after the **Wave Texture1** node, and label it as `ColorRamp2`. Move the black color stop to the `0.505` position and the white color stop to the `0.975` position.
15. Press *Shift* + *D* to duplicate the **ColorRamp2**, label it as `ColorRamp3`, and paste it right after the **Wave Texture2** node. Move the black color stop to the `0.495` position and the white color stop to the left end of the slider, and set **Pos** as `0.000`, as shown in the following screenshot:


File
Render
Window
Help
Back to Previous
Cycles Render
v2.71 | Verts:8118 | Faces:8024 | Tris:16048 | Objects:1/5 | Lamps:0/0 | Mem:24.90M | Cube
SHADERS
Wood
View
Select
Add
Node
Wood
Use Nodes

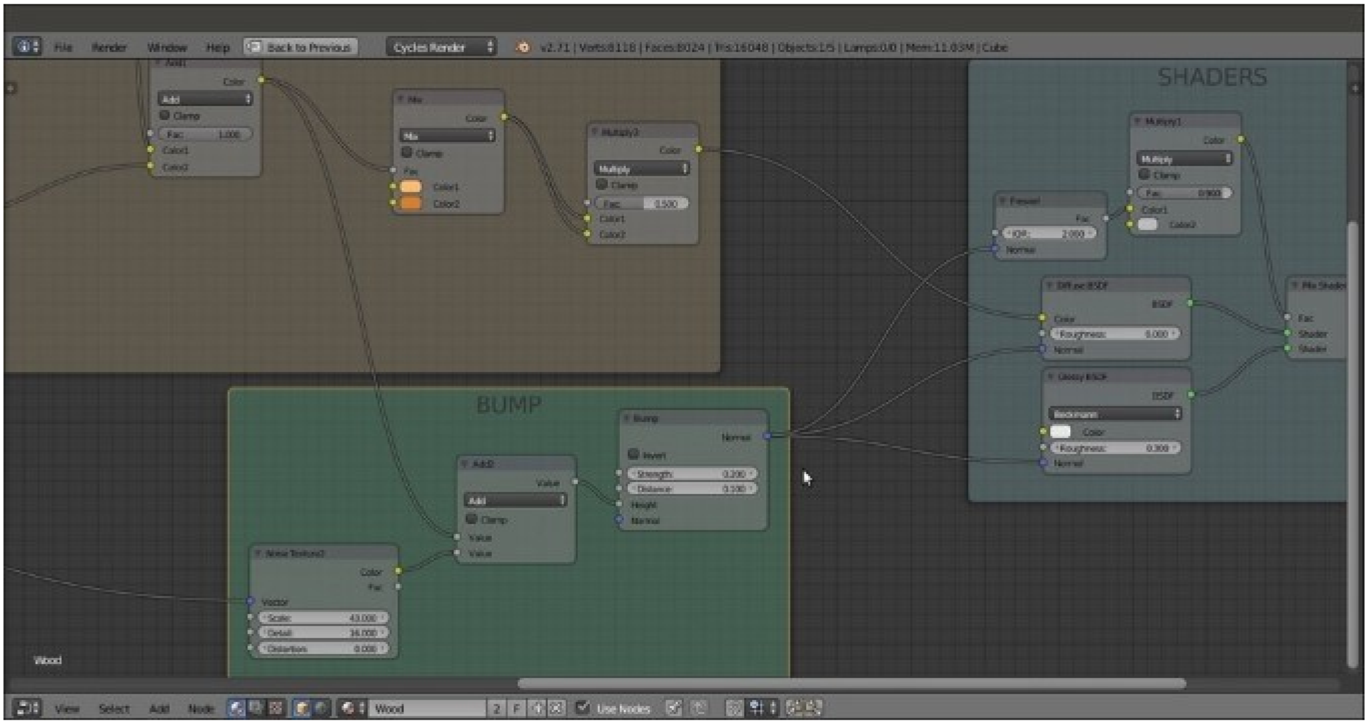
The textures required to draw the wood effect summed and connected to the shader part of the material

16. Now add a **MixRGB** node (press *Shift* + *A* and navigate to **Color** | **MixRGB**) and connect the **Add1** node's **Color** output to its **Fac** input socket. Set the **Color1** values of **R** to `1.000`, **G** to `0.500`, and **B** to `0.150`. Set the **Color2** values of **R** to `0.694`, **G** to `0.205`, and **B** to `0.027`.
17. Press *Shift* + *D* to duplicate the **MixRGB** node. Paste the duplicate right after the original node. Connect the **MixRGB** node's output to the **Color2** input socket, change **Blend Type** to **Multiply**, and label it as `Multiply3`.
18. Add a **Frame** (press *Shift* + *A* and navigate to **Layout** | **Frame**). Press *Shift* and select the three texture nodes, the three **ColorRamp** nodes, the four **MixRGB** nodes, and then the **Frame**. Press *Ctrl* + *P* to parent them. Label the frame as `COLOR`, as shown in the following screenshot:



Adding more color to the veining

19. Add a new **Noise Texture** node (press *Shift* + *A*, navigate to **Texture** | **Noise Texture**, and label it as `Noise Texture2`), a **Math** node (press *Shift* + *A* and navigate to **Converter** | **Math**), and a **Bump** node (press *Shift* + *A* and navigate to **Vector** | **Bump**).
20. Connect the **Mapping3** node's output to the **Vector** input socket of the **Noise Texture2** node. Then connect the **Color** output of this node to the second **Value** input of the **Math** node. Set its **Operation** to **Add**, label it as `Add2`, and connect its output to the **Height** input socket of the **Bump** node.
21. Set the **Bump** node's **Strength** value to `0.200`. Connect the **Normal** output of the **Bump** node to the **Normal** input of the **Fresnel**, **Diffuse BSDF**, and **Glossy BSDF** nodes inside the **SHADERS** frame. Set the **Noise Texture2** node's **Scale** value to `43.000` and **Detail** to `16.000`.
22. Go to the **Add1** node inside the **COLOR** frame, click on the output node, and drag it so that it is connected to the first **Value** input socket of the **Add2-Math** node.
23. Add a **Frame** (press *Shift* + *A* and navigate to **Layout** | **Frame**). Select the three nodes and then the **Frame**. Press *Ctrl* + *P* to parent them. Label the frame as `BUMP`, as shown in the following screenshot:



The bump pattern, based in part on the output of the veining

24. Save the file as `Wood.blend`.

How it works...

From steps 1 to 4, we built the basic shader using the usual **Diffuse BSDF** and **Glossy BSDF** nodes, mixed by a **Fresnel** value and multiplied by the values of a medium gray color.

From steps 5 to 18, we built the color of the wood's veins, adding three procedurals to be used as splitting factors for the two wood colors set in the penultimate **MixRGB** node. Using the last **Multiply3** node, we made the color more saturated (actually, we multiplied the values by themselves).

From steps 19 to 23, we built the bump using a noise grain summed to the veins' values by the **Add2-Math** node. We set a low value for the bump's **Strength** value, but you can use higher values (together with higher roughness values) to obtain less polished surfaces, which can give you different kinds of wood in the output.

Chapter 5. Creating Complex Natural Materials in Cycles

In this chapter, we will cover the following recipes:

- Creating an ocean material using procedural textures
- Creating underwater environment materials
- Creating a snowy mountain landscape with procedurals
- Creating a realistic earth as seen from space

Introduction

In Chapter 3, *Creating Natural Materials in Cycles*, we saw some of the simpler natural materials that are possible to build in Cycles, keeping them out of any landscape context to make them more easily understandable.

Now it's time to deal with more elaborate natural materials. In this chapter, we will examine the way to mix different basic shaders to mimic the look of complex natural objects and their environments (very often, these two things fit together neatly).