3.3.2 Tungsten halogen

The applications of conventional incandescent lamps are limited by their physical size and luminous efficiency. Raising the filament temperature to increase the luminous output has the effect of increasing the rate of blackening of the glass envelope, blackening which is a result of the evaporation of tungsten from the filament. By adding a halogen to the gas fill a chemical transport cycle involving the reaction of tungsten reduces the amount of blackening of the envelope. It is then possible to reduce the size of lamp, increase the pressure of the filling gas and thereby limit the loss of the tungsten from the filament.

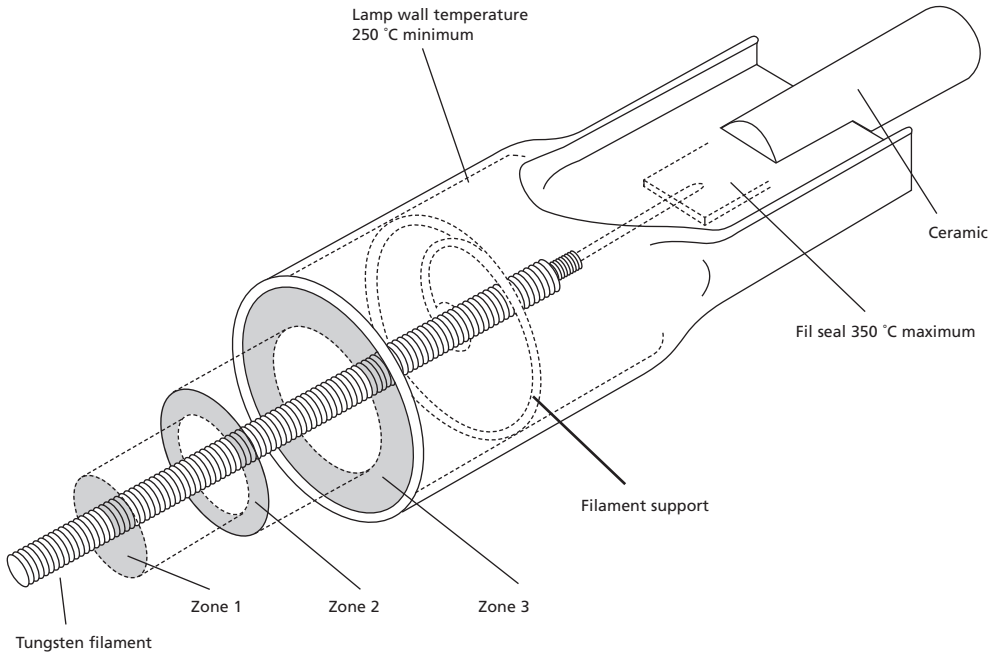

Figure 3.14 A representation of the tungsten halogen cycle

The chemistry of the tungsten halogen cycle is highly complex. However the key stages are:

- the halogen combining with the tungsten on the wall of the lamp (zone 3)
- the tungsten halide vapour mixing with the fill gas of the lamp (zone 2)
- the tungsten halide dissociating close to the filament of the lamp, leaving the halogen free to migrate though the fill gas to the lamp wall again and the tungsten being deposited on the filament (zone 1).

To enable an efficient cycle it is necessary for the wall of the lamp to run at a temperature above 250 °C; this means that the bulb has to be made from quartz or hard glass.