

= 10 @. @ 331 Å and c =

7 @. @ 343 Å) , where a is the length of each side of the hexagon and c is the height of the prism . The volume of each unit cell of vanadinite , given by the formula $V = a^2c \sin (60^\circ)$, is 678 @. @ 72 Å³ .

= = Characteristics = =

Vanadinite is in the apatite group of phosphates , and forms a chemical series with the minerals pyromorphite ($Pb_5 (PO_4)_3Cl$) and mimetite ($Pb_5 (AsO_4)_3Cl$) , with both of which it may form solid solutions . Whereas most chemical series involve the substitution of metallic ions , this series substitutes its anion groups ; phosphate (PO_4) , arsenate (AsO_4) and vanadate (VO_4) . Common impurities of vanadinite include phosphorus , arsenic and calcium , where these may act as an isomorphic substitute for vanadium . Vanadinite when containing a high amount of the arsenic impurity is known as endlicheite .

Vanadinite is usually bright @-@ red or orange @-@ red in colour , although sometimes brown , red @-@ brown , grey , yellow , or colourless . Its distinctive colour makes it popular among mineral collectors . Its streak can be either pale yellow or brownish @-@ yellow . Vanadinite may be transparent , translucent or opaque , and its lustre can range from resinous to adamantine . Vanadinite is anisotropic , meaning that some of its properties differ when measured along different axes . When measured perpendicular and parallel to its axis of anisotropy , its refractive indices are 2 @. @ 350 and 2 @. @ 416 respectively . This gives it a birefringence of 0 @. @ 066 .

Vanadinite is very brittle , producing small , conchoidal fragments when fractured . Its hardness is 3 ? 4 on the Mohs scale , about the same as a copper coin . Vanadinite is particularly heavy for a translucent mineral . It has a molar mass of 1416 @. @ 27 g / mole and its specific gravity can range between 6 @. @ 6 and 7 @. @ 2 because of impurities .

= = Uses = =

Along with carnotite and roscoelite , vanadinite is one of the main industrial ores of the element vanadium , which can be extracted by roasting and smelting . Vanadinite is also occasionally used as a source of lead . A common process for extracting the vanadium begins with the heating of vanadinite with salt ($NaCl$) or sodium carbonate (Na_2CO_3) at about 850 ° C to produce sodium vanadate ($NaVO_3$) . This is dissolved in water and then treated with ammonium chloride to give an orange @-@ coloured precipitate of ammonium metavanadate . This is then melted to form a crude form of vanadium pentoxide (V_2O_5) . Reduction of vanadium pentoxide with calcium gives pure vanadium .