

**SPINELS RENAISSANCE: THE PAST, PRESENT, AND FUTURE OF THOSE UBIQUITOUS MINERALS AND MATERIALS**

**The systematics of the spinel-type minerals: An overview†**

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**ABSTRACT**

Compounds with a spinel-type structure include mineral species with the general formula  $AB_2\phi_4$ , where  $\phi$  can be  $O^{2-}$ ,  $S^{2-}$ , or  $Se^{2-}$ . Space group symmetry is  $Fd\bar{3}m$ , even if lower symmetries are reported owing to the off-center displacement of metal ions. In oxide spinels ( $\phi = O^{2-}$ ),  $A$  and  $B$  cations can be divalent and trivalent (“2-3 spinels”) or, more rarely, tetravalent and divalent (“4-2 spinels”). From a chemical point of view, oxide spinels belong to the chemical classes of oxides, germanates, and silicates. Up to now, 24 mineral species have been approved: ahrensite, brunogeierite, chromite, cochromite, coulsonite, cuprospinel, filipstadite, franklinite, gahnite, galaxite, hercynite, jacobsonite, magnesiocromite, magnesiocoulsonite, magnesioferrite, magnetite, manganochromite, qandilite, ringwoodite, spinel, trevorite, ulvospinel, vuorelainenite, and zincochromite. Sulfospinel ( $\phi = S^{2-}$ ) and selenospinel ( $\phi = Se^{2-}$ ) are isostructural with oxide spinels. Twenty-one different mineral species have been approved so far; of them, three are selenospinel (bornhardtite, trüstedtite, and tyrellite), whereas 18 are sulfospinel: cadmoindite, carrollite, cuproiridsite, cuprokalinitite, cuprorhodsite, daubréelite, ferrosite, fletcherite, florensovite, greigite, indite, kalininite, linnaeite, malanite, polydymite, siegenite, violarite, and xingzhongite. The known mineral species with spinel-type structure are briefly reviewed, indicating for each of them the type locality, the origin of the name, and a few more miscellaneous data. This review aims at giving the state-of-the-art about the currently valid mineral species, considering the outstanding importance that these compounds cover in a wide range of scientific disciplines.

**Keywords:** Spinel, oxide spinel, sulfospinel, selenospinel