

## **Woodruffite: A new Mn oxide structure with $3 \times 4$ tunnels**

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### **ABSTRACT**

The mineral woodruffite,  $\text{Zn}_{x/2}^{2+}(\text{Mn}_{1-x}^{4+}\text{Mn}_x^{3+})\text{O}_2 \cdot y\text{H}_2\text{O}$ ,  $x \sim 0.4$  and  $y \sim 0.7$ , is the first known example of a new type of Mn oxide characterized by large tunnels that measure 3 and 4 octahedra ( $6.9 \times 9.2 \text{ \AA}$ ) on a side. These tunnels are rectangular in cross-section and are the largest of any yet reported in natural or synthetic Mn oxides. The thermal stability of woodruffite is comparable to that of todorokite and other large-tunnel Mn oxide phases, breaking down at  $\sim 300 \text{ }^\circ\text{C}$  and eventually transforming to a spinel-type structure. The woodruffite structure may serve as a model for a new class of octahedral molecular sieves with enhanced capabilities as catalysts and selective cation-exchange agents.