

High Pressure Mineral Structures: Their Observation and Prediction

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A number of minerals can be converted to high pressure forms in the laboratory, but in many cases, particularly for the ultimate structures in which silicon is six-coordinate, these forms must be predicted.

The exploration of the high pressure behaviour of a number of olivine, spinel, zircon and feldspar type compounds has provided some actual examples and many reference points for the extrapolation of the crystal chemistry of dense oxide compounds to the behaviour of dense silicates.

High Pressure Synthesis of some Transition, Metal Oxydes and Oxyhydroxydes.

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High pressure technic has been used successfully in the synthesis of transition metal oxydes with high valency states, which requires highly oxydizing conditions. As an example, the method allowed us to perform the first real synthesis of cobalt sesquioxide as a well crystallised powder. It was obtained under 80 kb and 850°C. $\text{Co}_2\text{O}_3\text{I}$ has the corindon structure with the Co^{3+} in low spin state. When heated at 400°C for a few seconds, it transforms in a new phase, $\text{Co}_2\text{O}_3\text{II}$, which still has the corindon structure but with cobalt in high spin state. The volume change is about 7%. The transformation is not reversible. This suggests that $\text{Co}_2\text{O}_3\text{II}$ is the stable phase at normal pressure and that $\text{Co}_2\text{O}_3\text{I}$ must be regarded as a metastable high pressure phase. This provides a good example of a high-spin low-spin transition obtained by high pressure.