

Zircon under compression: new insights into the material property

*Sean R Shieh¹, Giancarlo Jones¹, Desmond E Moser¹, Robert J Clarsson¹

1. University of Western Ontario

Zircon is a popular accessory mineral on the crust and shallow mantle of the Earth and other planets and is regarded as a strong material that can resist to extreme environments that can be used for age determination of important geological events. However, accurate age determination may be affected by the deformation of crystal zircon associated with the lead loss. In fact, the mechanism of the deformation of zircon is poorly understood. Furthermore, reidite phase is believed to be the high-pressure form of zircon but the formation of reidite is still under debate. To evaluate the mechanism of the deformation of zircon and phase transition of zircon to reidite, zircons collected from field and lab synthesis are used to study the mechanism of twining, deformation and reidite formation, together with model calculations. Our theoretical calculations of the twin nucleation show that the shear stress for natural sample is in the range of 1.7-2.6 GPa, suggesting a preferable shock-induced mechanism. The hardness of zircon estimated from nano-indentation is about 13 GPa, which is stronger than plagioclase and clinopyroxen but weaker than garnet. Interestingly, the reidite transformation may be due to martensitic transformation.

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