Dislocation textures in shock-compressed MgO and their formation mechanisms

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Deformation phenomena under high-pressure in Earth and planetary science occur under the shock compression as well as under the static or quasi-static compression. However, the studies on dislocation textures of materials under the shock compression are very limited, compared to those under the static or quasi-static compression. To fill such gap, the shock compression experiments on MgO were carried out and the dislocation textures of the recovered samples were examined under TEM to consider the formation mechanisms of those dislocation textures.

The shock compression experiments of single-crystal MgO were performed with a powder gun at the Institute of Pulsed Power Science, Kumamoto Univ. The shock compression experiments were done along the <100> and <110> directions. The recovered MgO samples were examined under 200 kV TEM at the Geodynamics Research Center, Ehime University.

In the previous studies, the Burgers vector of MgO is always $(\boldsymbol{a}_1 + \boldsymbol{a}_2)/2$ and the slip planes are mostly {110} and {100}. The present TEM examination showed that the sample under the <100> compression has dislocations of only the {110} slip plane, while under the <110> compression the sample has dislocations of only the {110} slip plane at low pressure but has dislocations of both {110} and {100} slip planes at higher pressure, indicating that the slip plane changes from {110} to {100} with increasing pressure. In addition to these results the dislocation textures which are usually not observed in the static or quasi-static compression, were also observed. In the presentation, the formation mechanisms of the observed dislocation textures are also discussed.

Keywords: shock compression, MgO, TEM observation, slip system of dislocation

