Structual phase transition and microstructures of (Mg,Fe)SiO3 majorite

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(Mg,Fe)SiO3 majorites synthesized at 20 GPa and 1950-2200 C, and natural majorite in the shocked Tenham meteorite were examined by ATEM. Although synthetic majorites in all the recovered specimens had a tetragonal symmetry, specimens quenched from temperatures above ~1950 C showed the frequent of {101} twins and modulated structures, while specimens quenched from temperature below ~1950 C showed none or few of them. On the other hand, natural cubic (Ia d) majorite shows neither tweed structure nor twinning. These contrasting observations suggest that {101} twin lamellae and tweed structures in tetragonal majorite were formed by the cubic-tetragonal phase transition during cooling. Cubic majorite seems to have a wide stability field at temperatures higher than ~1950 C at 20 GPa.