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Possible magnetic fields generated in oxides in Super Earths W.J. NELLIS, Harvard University — Planetary magnetic fields are generated by convective motion of conducting fluids. The highest pressure on oxides in Earth is about 130 GPa (1.3 Mbar) at about 3000 K at the core-mantle boundary. At these conditions electrical conductivities and viscosities of solid oxides are too small and large, respectively, to produce a significant contribution to Earth's magnetic field. However, oxides in super-Earth exoplanets reach interior pressures and temperatures much larger than those in Earth. Recent work has shown that solid Al2O3 is highly disordered up to ∼400 GPa and probably becomes a metallic glass with minimum metallic conductivity (MMC) at ∼300 GPa under both shock and static compression. MMC is essentially independent of material and so all oxides might behave this way. This insulator-metal transition is probably entropy-driven by energy absorbed in breaking chemical bonds, which leads to metallic energy bands. Since Al2O3 is estimated to melt on the Hugoniot at ∼400 GPa, viscosity is expected to decrease near this pressure. Depending on existence and nature of dynamos, the possibility exists that many extrasolar rocky planets have finite external magnetic fields without fluid Fe cores.

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