Electrical conductivity of warm dense silica from double-shock experiments

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When submitted to extreme pressures and temperatures, materials can drastically change their electrical and optical properties. In particular, they can turn from insulating to conductive. For materials relevant to planetary science, electrical conductivity is a key parameter to address the possibility for extra-solar planets to generate and sustain magnetic fields. Of particular interest is the case of silicates, as in their (partially-)molten mantles conductive silicates could represent an intriguing alternative for an effective dynamo process even in the presence of a fully crystallized iron core.
Experimentally, dynamic compression is the most promising approach to explore molten silicates under extreme conditions. Although most experimental studies are restricted to the Hugoniot curve, a wider range of conditions must be reached.
Here we present direct measurements of equation of state and two-colour reflectivity of double-shocked α-quartz on a large ensemble of thermodynamic conditions. Combining experimental reflectivity data with *ab initio* simulations we determine the electrical conductivity. We find that it is almost constant with pressure while highly dependent on temperature. From our results we also estimate that dynamo processes are likely in Super-Earths' mantles.