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Novel setup for geoelectrochemical measurements in a hydrothermal diamond anvil cell

KIRILL VLASOV, SVEN FRIEDEMANN AND OLIVER THOMAS LORD

University of Bristol

Presenting Author: kirill.vlasov@bristol.ac.uk

Knowledge of the electrical conductivity of crustal and upper mantle aqueous fluids is necessary for the interpretation of magnetotelluric data [1]. NaCl and KCl are the most important solutes present in such fluids [2,3], yet direct measurement of their electrical conductivity performed in hydrothermal diamond anvil cells (DACs) cover a relatively limited pressure and temperature range up to 600-750 ºC and 1-2 GPa [4,5]. This is mainly due to the absence of suitable dielectrics required for the electrode insulation.

Here, we will describe a new DAC electrochemical assembly that overcomes this issue by combining Al_2O_3 ceramic insulation deposited on the gasket and noble metal electrodes, sputtered on top of a single diamond culet (Fig. 1). In addition to an improved pressure-temperature range, that is estimated to be >5 GPa and 1000 ºC, such an assembly offers a very stable cell constant [6] that can be determined with great precision. Unlike earlier designs, both 2-probe and true 4-probe (Fig. 2) electrical conductivity measurements can be performed with relative ease.

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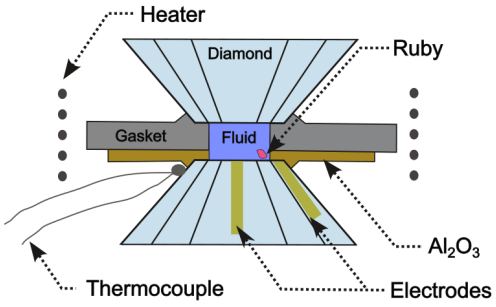

Figure 1. Design of the experimental setup

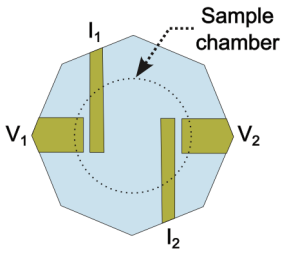

Figure 2. Electrode placement for a 4-probe electrical conductivity measurement