# Electrical conductivity of peraluminous granitic melt with implications for melting in the Tibetan Crust

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Magnetotelluric and seismological studies suggested the presence of partial melts in the mid to lower Himalaya-Tibetan crust. However, the melt fractions inferred by previous work were based on presumed rather than experimentally determined electrical conductivity of melts. The melt, if present, is expected to derive from metapelites and thus to have composition similar to Himalayan peraluminous leucogranite.

We have carried out measurements on the electrical conductivity of peraluminous granitic melts with 0.16-8.4 wt% $H_2O$ at 600-1300°C and 0.5-1.0 GPa. Experimental results show that the electrical conductivity of peraluminous granitic melt increases with increasing temperature but decreases with pressure, which can be modeled by the Arrhenius law. Fitting yields activation enthalpy at 1.0 GPa decreasing from 89 kJ/mol for anhydrous melt to 35 kJ/mol for the melt with 8.4 wt% $H_2O$. The obtained activation volumes are 10-17 $cm^3$/mol, which are comparable to peralkaline granitic melt. Compared to the peralkaline melt, peraluminous melt shows lower electrical conductivity at dry condition, but this difference quickly diminishes at $H_2O$ greater than 2 wt%. This implies that water has stronger effect on enhancing the electrical conductivity of peraluminous melt. Based on our data, the observed electrical anomalies in the Himalaya-Tibetan crust could be explained by melt fraction of 2-12% in the northwestern Himalaya, 11-31% in the southern Tibet, and 6-33% in the central and northern Tibet for 6-9 wt% melt $H_2O$ content. Possible reasons for our inferred melt fractions being higher than seismological constraints include (1) the real melts are more Na and $H_2O$ rich; (2) the effect of melt reducing seismic velocities was overestimated; (3) the anomalies at some locations are due to fluids. Further work is required to assess which interpretation is more realistic.