Phase diagram of pressure-induced superconductor $\beta$-(BDA-TTP)$_2MX_4$ ($M=$Fe, Ga and $X=$Cl, Br) with localized magnetic moments

E.S. CHOI, D. GRAF, T. TOKUMOTO, J.S. BROOKS, NHMFL/Florida State Univ., JUN-ICHI YAMADA, University of Hyogo — We have investigated transport and magnetization properties of $\beta$-(BDA-TTP)$_2MX_4$ ($M=$Fe, Ga and $X=$Cl, Br) as a function of pressure, temperature and magnetic field. The title material undergoes metal-insulator transitions above 100 K at ambient pressure. The insulating phase is suppressed with pressure and superconductivity eventually appears above $P_c= 4.5$ kbar ($X=$Cl) and 13 kbar ($X=$Br). The general temperature-pressure ($TP$) phase diagram is similar each other, while higher pressure is required for $X=$Br compounds to suppress the insulating state and induce the superconductivity. Pressure dependent DC magnetization studies on $\beta$-(BDA-TTP)$_2$FeCl$_4$ compound revealed that the AFM ordering persist well above $P_c$. In spite of similarity of phase diagram between $M=$Fe and $M=$Ga compounds, magnetoresistance results show distinct behaviors, which indicates the magnetic interaction with the conduction electrons are still effective. The comparison between $X=$Cl and $X=$Br compounds suggests the anion-size effect rather than the existence of localized magnetic moments plays more important role in determining the ground state.

1We acknowledge NSF-DMR 0602859 for partial support for this work.

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Date submitted: 06 Dec 2006

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