Superconducting critical field of americium up to 25 GPa.

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Am metal undergoes several structural phase transitions in the 10-20 GPa pressure range [1] and displays interesting superconducting behaviour as a function of the pressure [2]. We have performed resistivity measurements under pressure on 2 isotopes of americium metal: ^{241}Am and ^{243}Am.

The behavior of the critical current $J_c(p)$ and $T_c(p)$ have been determined for ^{241}Am up to 16 GPa. J_c values are close to 10^7 A/m^2 and increase linearly with T_c. The overall $T_c(p)$ diagram is identical to that obtained previously with ^{243}Am [2]. Due to the important self-heating effect (~110 mW/g) we could not observe any isotopic effect. Self-damage effects do not seem to decrease T_c. On the contrary, at fixed pressure T_c slightly increases with time.

The $T_c(p)$ diagram for ^{243}Am has been determined till 25 GPa and down to 400 mK (see figure 1).

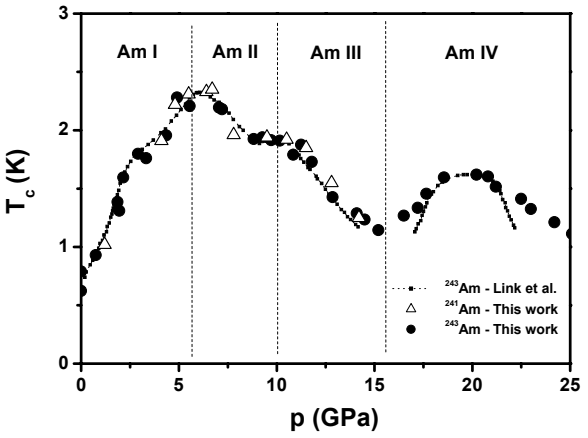

Fig. 1: $T_c(p)$ diagram of Am metal up to 25 GPa.

In the 14-18 GPa pressure range superconductivity is still observed so that Am III remains a superconductor. At the highest pressure of our experiment, p~25 GPa (in Am IV phase) T_c first increases and then linearly decreases with pressure with a slope of -0.15 K/GPa. Superconductivity is extrapolated to collapse around 30 GPa.

The variation of the critical field $H_c(T)$ at different pressures is illustrated in figure 2. Previous determination of $H_c(T)$ [3] indicates Am metal at ambient pressure to be a type I superconductor with H_c~500 Oe. With applying pressure, we observe a large enhancement of $H_c(T)$. Up to 6 GPa the global shape remains close to the orbital limit.

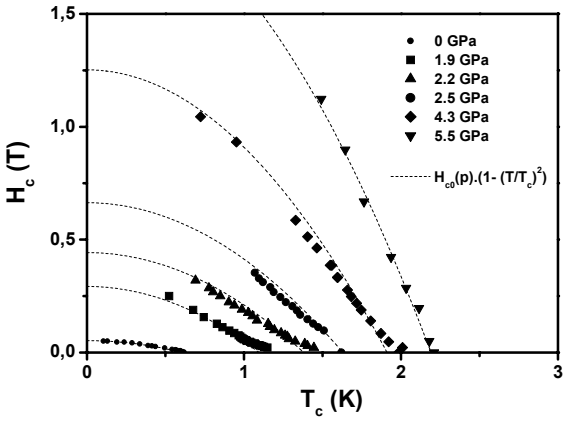

Fig. 2: Variation of $H_c(T)$ at different pressures.

By applying pressure, delocalisation of the 5*f* states is enhanced [1] and both the DOS and the carriers effective mass may change as a function of pressure causing the large $H_c(T)$ enhancement observed

References

[1] S. Heathman et al., Phys. Rev. Lett. 85 (2000) 2961
[2] P. Link et al., J. Alloys Comp. 213 (1994) 148
[3] J. L. Smith et al., J. Phys. T 40 (1979) C4-138