Cryogenic Magnetoresistance of CuAg Alloy Solidified Under a 12 T High Magnetic Field

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Introduction

CuAg composites are the conductors for both DC resistive and pulsed magnets. The magnetoresistance (MR) effect is important for the peak temperature in magnet coils [1]. Numerous investigations [1, 2] indicated that MR was closely related to the microstructural features of the materials and changes in the microstructure might affect the MR.

Experimental

Cu-28wt%Ag alloy and Cu -72wt% Ag eutectic alloy were solidified with or without an external superconducting high magnetic field (HMF) of 12 T at NEU, China. The MR was measured at 77 K by a standard four-probe method in a resistive magnet up to 31.2 T at National High Magnetic Field Laboratory, USA.

Results and Discussion

Figure 1 shows that both transverse and longitudinal MR's increase with increasing DC magnetic field, and transverse MR was always larger than the longitudinal. The MR of samples solidified under 12 T is greater than without HMF in both Cu28Ag and eutectic composites. For eutectic composites shown in Fig.2b, the maximum transverse MR values in samples solidified with and without HMF are 25.5% and 25.2%, respectively. Our experimental results are in good agreement with the maximum MR of 21% reported at 77K and 27 T in as-cast Ag-Cu alloy [1].

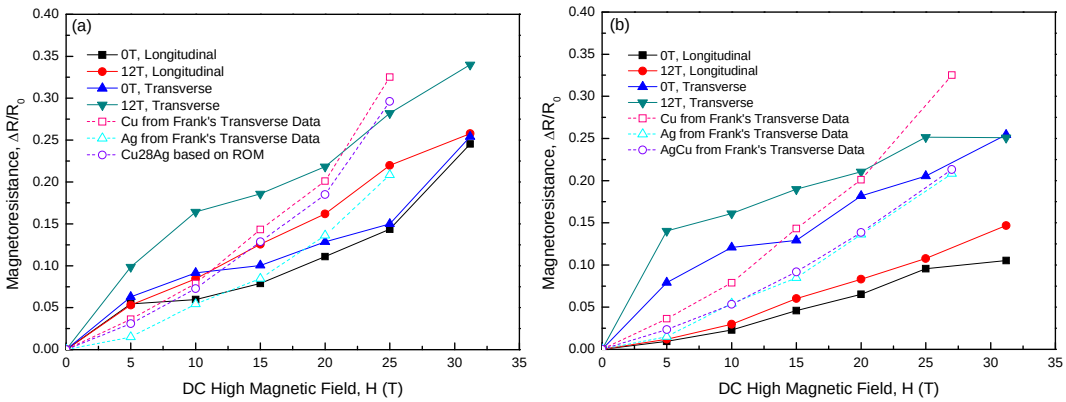

Fig.1 The transverse and longitudinal MR of (a) Cu28Ag alloy, and (b) eutectic alloy, at 77K as a function of applied DC high magnetic field, the dashed lines corresponding to the data from reference [2], Cu28Ag ROM curve is predicted on the rule of mixture according MR of Cu and Ag from Reference [2]

Conclusions

The investigation of cryogenic MR of CuAg alloys with different chemistries and microstructure showed that a link between the microstructure induced by HMF and MR.

Acknowledgements

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References

[1] Freudenberger J., et al. Cryogenics, 46, 724-729 (2006).
[2] Heringhaus F.: Shaker, 1998.