Frequency dependent flux dynamics and activation energies in pnictide bulk $(\text{Ba}_{0.56}\text{K}_{0.44})\text{Fe}_2\text{As}_2$ superconductor

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**Measurement**

Ac susceptibility vs. temperature as a function of ac magnetic field and frequency in dc magnetic fields 0-18 T

**Background**

Complex ac susceptibility $\chi = \frac{dM}{dH} = \chi' + i\chi''$

Frequency shift of $\chi''$ peak in temperature $T_p$ provides information about ac losses which are maximum at $T_p$

**Analysis**

Arrhenius expression $f = f_0 \exp(-E_a/kT)$. Here $E_a$ is the thermal activation energy, $k$ is the Boltzmann’s constant, and $f_0$ is a term proportional to the characteristic hopping frequency.

**Results**

Irreversibility lines determined by $T_p$ show significant broadening with ac field, frequency and dc field.

**Conclusion**

- We determine flux activation energies as a function of ac and dc magnetic fields in $(\text{Ba}_{0.56}\text{K}_{0.44})\text{Fe}_2\text{As}_2$ bulk superconductor. The activation energy ranges from 8822 K at 0 T to 1100 K at 18 T for $H_{dc}=80$ A/m. We determine pinning transition field (here around 2 T). The activation energy decreases rapidly as ac field increases from 80 A/m to 800 A/m for constant dc field.
- We plot the temperature shift of maximum ac losses as a function of ac field, frequency, and dc field.
- Irreversibility lines show broad dependence on the magnitude of the ac field, frequency, and dc field.
- We show breakdown of the Arrhenius Anderson-Kim model.