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Relation between the Critical Current and the n-value of ReBCO Thin Films: A Scaling Law for Flux Pinning of ReBCO Thin Films

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Detailed field and angle dependences of the critical current and the *n*-value for a SmBCO coated conductor have been measured. It was found that the field dependence of the *n*-value can be fitted by an empirical power law with three parameters including the irreversibility field. We also found that there is a correlation between the critical current and the *n*-value which can be describe by the Kramer model including thermal activation. The model fits the field dependence of the empirical critical current data at various angles and temperatures with three fitting parameters, the pinning force maximum, the *g*-factor and the upper critical field. The upper critical field found from fitting was higher than the irreversibility field and the angular dependence of the upper critical field is in agreement with the Tinkham model. The pinning force maximums do not show a correlation with the upper critical or the irreversibility fields, which is attributed to the difference in the pinning mechanism with a variation of the angle. It was further shown that the angular dependence of the critical current can be calculated by the Kramer model including thermal activation with empirical angular dependence expressions for each parameter. The critical current data reported by Yamada *et al.* [Supercond. Sci. Technol. **17**, S25 (2004)] for YBCO thin films on various substrates deposited by pulsed laser deposition method also can be described by the Kramer model including thermal activation and the angular dependences of each parameter were compared with the SmBCO coated conductor fitting results.

keywords : *Re*BCO thin film, coated conductor, angular dependence, the *n*-value, the Kramer model, the Tinkham model