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## Pressure Dependence of the Kondo Resistance Anomaly and the Pair Breaking Effect in La-Ce Alloys

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The pressure dependence of the pair breaking effect and of the resistance anomaly was measured in LaCe alloys. The results indicate that the maximum in the pressure dependent pair breaking effect is due to a monotonic shift of the Kondo temperature  $T_k$  with pressure from values  $T_k \ll T_{c0}$  to  $T_k \gg T_{c0}$ , where  $T_{c0}$  is the superconducting transition temperature of pure lanthanum.

### Introduction

Measurements of the superconducting transition temperature  $T_c$  of La-Ce alloys by Smith<sup>1</sup> have shown that the depression of  $T_c$  by paramagnetic impurities of concentration  $c$  is pressure dependent. Coqblin and Ratto<sup>2</sup> have explained this effect by assuming a pressure dependent enhancement of the exchange parameter  $|J|$ , defined by the Hamiltonian  $H = -JS \cdot \sigma$  where  $S$  and  $\sigma$  are the spins of the localized impurity and the conduction electron, respectively. Referring to the theories of Zuckermann<sup>3</sup> and Müller-Hartmann and Zittartz<sup>4</sup>, a relative maximum of  $\Delta T_c / \Delta c$  has been predicted as a function of pressure<sup>5</sup>. According to these theories  $\Delta T_c / \Delta c$  is a function of  $T_k / T_{c0}$  ( $T_k$  = Kondo Temperature,  $T_{c0}$  = superconducting transition temperature of the host metal), and the maximum of  $\Delta T_c / \Delta c$  corresponds to a certain value of  $T_k / T_{c0} = \vartheta$  which amounts to  $\vartheta \approx 2$  (Ref.<sup>3</sup>) or  $\vartheta \approx 12$  (Ref.<sup>4</sup>). For a Kondo alloy with  $T_k \ll T_{c0}$  (at zero pressure) the depression of the transition tempera-

<sup>1</sup> Smith, T. F.: Phys. Rev. Letters **17**, 386 (1966).

<sup>2</sup> Coqblin, B., Ratto, C. F.: Phys. Rev. Letters **21**, 1065 (1968).

<sup>3</sup> Zuckermann, M. J.: Phys. Rev. **168**, 390 (1968).

<sup>4</sup> Müller-Hartmann, E., Zittartz, J.: Z. Physik **234**, 58 (1970).

<sup>5</sup> Umlauf, E.: In: Sommerschule für Supraleitung. Steibis 5.-10. Oct. 1969, ed. by Universität Köln.

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