

## Debye temperature in YBa<sub>2</sub>Cu<sub>3</sub>O<sub>x</sub> as measured from the electron spin-lattice relaxation of doped Yb<sup>3+</sup> ions

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### Abstract

The electron spin-lattice relaxation (SLR) times  $T_1$  of Yb<sup>3+</sup> ions were measured from the temperature dependence of electron spin resonance line width in Y<sub>0.99</sub>Yb<sub>0.01</sub>Ba<sub>2</sub>Cu<sub>3</sub>O<sub>x</sub> with different oxygen contents. Raman relaxation processes dominate the electron SLR. Derived from the temperature dependence of the SLR rate, the Debye temperature ( $\Theta_D$ ) increases with the critical temperature  $T_c$  and oxygen content  $x$ . This relationship between  $T_c$  and  $\Theta_D$  can be well understood in terms of the modified Bardeen-Cooper-Schrieffer theory of phonon mechanism for a strong electron-phonon coupling.

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