Transition Metal (M = Rh and Ta) Effects on the Electrical Properties and AC Susceptibility of $\text{Tl}_{0.85}\text{Cr}_{0.15}\text{Sr}_{2-x}\text{M}_x\text{CaCu}_2\text{O}_7$ Superconductor

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The effects of transition metal (M = Rh and Ta) on $\text{Tl}_{0.85}\text{Cr}_{0.15}\text{Sr}_{2-x}\text{M}_x\text{CaCu}_2\text{O}_7$ (Tl-1212) superconductor for $x = 0 - 0.04$ (M = Rh) and $x = 0 - 0.30$ (M = Ta) were studied. X-ray diffraction patterns showed Tl-1212, Tl-1201 and $\text{Ca}_{0.3}\text{Sr}_{0.7}\text{CuO}_2$ phases in the samples. Scanning electron micrographs (SEM) showed that the grain size decreased with Rh. The transition temperature increased when Rh and Ta were substituted for low levels. AC susceptibility measurements showed the highest transition temperature $T_{c\chi} = 98$ K for Rh ($x = 0.02$) and 96 K for Ta ($x = 0.3$) samples. The peak temperature, T_p of the imaginary susceptibility χ'' was the highest for Rh with $x = 0.02$ ($T_p = 93$ K) and Ta with $x = 0.30$ ($T_p = 91$ K). Rh and Ta improved the onset transition temperature of $\text{Tl}_{0.85}\text{Cr}_{0.15}\text{Sr}_{2-x}\text{M}_x\text{CaCu}_2\text{O}_7$ from 97 K to 103 K and 104 K, respectively.

Keywords: transition metal; Tl-1212 phase; AC susceptibility

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