Impact of the reduction process on the long-range antiferromagnetism in Nd$_{1.85}$Ce$_{0.15}$CuO$_4$

PIERRE RICHARD, Universite de Sherbrooke, MARIO POIRIER, Universite de Sherbrooke, SERGE JANDL, Universite de Sherbrooke — In contrast to the hole-doped high-temperature superconductors, for which a Cu$^{2+}$ long-range antiferromagnetic order is suppressed at low doping, the antiferromagnetic order is more robust in the electron-doped 2-1-4 cuprates RE$_{2-x}$Ce$_x$CuO$_4$ (RE = Pr, Nd, Sm, Eu) and persists up to optimal doping. Recent neutron measurements have suggested that the Cu$^{2+}$ Néel temperature decreases after the reduction of the as-grown samples. This questions the competition between the antiferromagnetic and superconducting ground states, as well as the role of the reduction process which triggers superconductivity in these materials. A recent ultrasonic study have revealed ultrasonic anomalies around 4 K related to competing Nd$^{3+}$-Nd$^{3+}$ and Nd$^{3+}$-Cu$^{2+}$ interactions. We present an ultrasonic study of Nd$_{1.85}$Ce$_{0.15}$CuO$_4$ in the reduced and oxygenated states. While ultrasonic anomalies are found below 10 K in the oxygenated state, in both the C$_{66}$ elastic moduli and the corresponding attenuation $\alpha$, no anomaly is observed in the reduced and superconducting state. We attribute this effect to the suppression of the Cu$^{2+}$ long-range antiferromagnetic order due to the presence of oxygen vacancies in the CuO$_2$ planes of reduced samples.

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