

## SINTERING-DRIVEN IBLC FORMATION IN CCTO

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Calcium copper titanate ( $\text{CaCu}_3\text{Ti}_4\text{O}_{12}$ , CCTO) has attracted significant attention due to its colossal dielectric constant (CDC),  $\epsilon' \sim 10^4$  at room temperature, and remarkable thermal stability [1]. The origin of this dielectric response has been the subject of extensive debate. Intrinsic mechanisms, such as structural strain, compete with extrinsic models, particularly the Internal Barrier Layer Capacitance (IBLC) model, which attributes the CDC to semiconducting grains separated by insulating grain boundaries. Neutron scattering studies have shown that CCTO exhibits a conventional antiferromagnetic order that sets in at a low Néel temperature ( $T_N \approx 24$  K), indicating a clear separation of scales between magnetism and the CDC observed at room temperature [2]. Additional experimental evidence, such as Mn or Fe doping, that suppresses the CDC by reducing grain conductivity, supports a central prediction of the IBLC model [3]. A systematic sintering study revealed that at 980 °C the ceramics exhibit resistive grains and  $\epsilon' \sim 10^2$  (intrinsic character), whereas samples sintered above 1050 °C develop a core-shell microstructure, with semiconducting cores surrounded by resistive shells, forming the IBLC structure [4]. These findings reinforce the microstructural interpretation of the CDC in CCTO, confirming its potential for high-permittivity electronic applications.

**Keywords:** CCTO, Colossal Dielectric Constant, IBLC, Neutron Scattering.

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