

Manufacturing Grain Textured Piezoelectric Ceramic Transducer Components

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For many decades metals and polymers benefitted from the ability to enhance electrical and mechanical performance by creating highly directional microstructures via rolling, drawing, directional cooling, or other similar processing techniques. Meanwhile technical ceramics largely remained unimproved with respect to commercialized products. This presentation outlines the process technology and scale up considerations for tailoring asymmetric, directionally oriented ceramic microstructures, with a focus on achieving near single crystal performance from highly oriented ceramic piezoelectric materials. The key principle exploited is the ability of highly anisotropic grains to be added to and then aligned inside a ceramic green body such that they seed pronounced asymmetric grain growth. Critical processes including template synthesis, template alignment via tape casting, part fabrication, process controls, and process characterization will be discussed. The engineering challenges associated with scaling each step will be outlined as will observations regarding process variability.