

High-Intensity Electric Nano Pulsing

Monday, 31 August 2026 14:11 (30 minutes)

A novel field-assisted materials processing technique based on the electro-nano-pulsing (ENP) method has been developed, along with a device capable of applying electric pulses with ultra-high intensity ($\sim 10^{11}$ A/m²) and ultra-short duration (< 1 μ s).

This technology activates non-equilibrium structural evolution at nanometer spatial scales and nanosecond temporal scales, primarily affecting grain boundaries in polycrystalline materials. Owing to the large difference in electrical resistivity between the grain interiors and grain boundaries, highly localized Joule heating can be achieved.

Additional effects include localized modification of the material structure at the micro- and nanoscale without significant changes in grain size. Ni–Cr wires processed by ENP exhibit unique structures and properties.

Beyond bulk materials processing, the ENP technology has been extended to electrically driven, non-equilibrium densification of powder materials. Ultra-rapid neck formation and densification occurring within milliseconds have been demonstrated, for example, in pressure-assisted ENP sintering of 316L stainless steel. Experimental observations of electrically driven mass transport and interfacial phenomena at the particle scale provide new insights into the fundamental mechanisms of electric field-assisted sintering.

Professional Status of the Speaker

Senior Scientist

Interest in submitting a paper in a special issue of

Journal of the European Ceramic Society (Elsevier)

Invitation letter for visa

No

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Session Classification: Field assisted sintering technology/Spark Plasma Sintering FAST/SPS

Track Classification: Group 3: Field assisted sintering technology/Spark Plasma Sintering FAST/SPS