

Ceramic Magnetoelectric Relay for High-Frequency Switching

Technology Domain: Electrical

Patent Application Number: 202241035440

Status (Patent/TRL): Granted Patent / TRL 3

Technology Summary:

This invention introduces a novel ceramic composites-based portable electromagnetic relay switch designed for high-frequency applications. The key technical solution involves synthesizing a magnetoelectric (ME) ceramic composite of $(1-x)\text{Y}_3\text{Fe}_5\text{O}_{12} + (x)\text{Ba}_0.8\text{Pb}_0.2\text{TiO}_3$ (Yttrium Iron Garnet + Barium Lead Titanate) using a microwave double sintering technique. This method ensures uniform heating and homogeneous grain growth, overcoming limitations of conventional sintering. The key inventive feature is the ME composite's ability to act as a switch that operates in "OFF" mode at high frequencies (above 15MHz) by exhibiting diamagnetic behavior, thus protecting electrical systems from damage. This contrasts with traditional metal-based relays that fail at high frequencies.

Results demonstrate rapid operational (5 ns) and reset (123 ns) speeds, and the switch exhibits the Hopkinson effect, indicating efficient high-frequency switching. The use of this chemically inert, lightweight, and robust ceramic relay is for high-frequency devices, communication systems, and power converters, offering a reliable, cost-effective, and portable alternative to conventional metal relays, with reduced noise and no physical contact requirements.

