Fabrication of ceramic membrane applying a high voltage on conductive filler loaded epoxy matrix composites.

Akira KISHIMOTO

Institute of Industrial Science, University of Tokyo

Shingo HIRANO

Research Fellow, Japan Science Promotion Councile

Summary

We present the first observations of thermal-electrical breakdown in disordered conductor-insulator composites with a high electric field. This differs from simple electrical breakdown governed by local heat. When a large current flows through the most conductive pathway in a composite, the construction of the current at the most electro-resistive point in the pathway increases the Joule heat dissipation, and a localized thermal-electrical domain or hot spot appears on the composite.

The hot spot clearly begins in one of the metallic electrode/material interface regions. The spot grows with time, following a zigzagging percolative conduction pathway. Finally, when the hot spot connects both electrodes it acts as an electric filament through the film and the remarkable visible light emission is observed. The thermal-electrical breakdown of the disordered conductor-insulator composite results from the local conductivity; the hot spot starts at the most resistive point on one of the most conductive pathways and the breakdown progresses as the hot spot evolves.