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Fine ceramics (advanced ceramics, advanced technical ceramics) — Ultraviolet photoluminescence image test method for analysing polytypes of boron- and nitrogen-doped SiC crystals

Céramiques techniques — Méthode d'imagerie de photoluminescence ultraviolette pour l'analyse des polytypes dans les cristaux de SiC dopés à l'azote et au bore

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Foreword

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This document was prepared by Technical Committee ISO/TC 206, *Fine ceramics*.

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Introduction

Silicon carbide (SiC), which has a close-packed crystal structure, is a promising wide-bandgap (WBG) material applicable to laser diodes (LDs), light-emitting diodes (LEDs) and electronic power devices.

Polytype inclusion generated during SiC growth is a common problem. During crystal growth, many types of SiC-stacking can occur within the bulk of a single sample. These different stacking-order types are called “polytypes.” Polytypes have identical close-packed planes but differ in the stacking sequence on the axis that is perpendicular to these planes.

SiC has more than 200 known polytypes, but most polytypes are rare, except types 2H, 4H, 6H, 15R and 3C. For example, 4H-SiC is the material used for power production in devices because of its excellent physical properties. These SiC polytypes have the same density and Gibbs-free energy but different electronic band structures. The different band structures cause different wavelengths of luminescence induced by incident ultraviolet (UV) light.

SiC can be grown using several crystal-growth techniques, such as physical vapor transport (PVT), chemical vapor deposition (CVD) and top-seeded solution growth (TSSG). Polytype inclusion in bulk SiC is one of the drawbacks during production.

Therefore, a rapid test method to discriminate between polytypes would be useful for the development and mass production of SiC crystals.

This document specifies a test method to evaluate the polytypes and their SiC ratios by UV-induced photoluminescence using non-contact and full-field measurement techniques.