Current Developments in the Field of Alumina-Based Continuous Fibers

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Abstract

Oxide ceramic continuous fibers represent an important class of high-performance materials for applications under extreme thermo-mechanical and oxidative conditions. In contrast to non-oxide ceramic fibers, alumina- and mullite-based oxide fibers combine high temperature stability, oxidation resistance and favorable specific mechanical properties, making them attractive reinforcement materials for oxide ceramic matrix composites (OCMCs).
Despite their technological maturity, industrial oxide fiber production remains limited to comparatively few material systems and small global production volumes, resulting in high material costs and restricted market penetration. At the same time, growing demand for OCMCs, increasing industrial manufacturing capacities and renewed efforts toward European supply chain independence indicate a potential transition from niche technology toward broader commercialization.

This contribution highlights recent developments in aluminium oxide-containing (i.e. corundum and mullite) ceramic continuous fibers from both an industrial and R&D perspective, with particular emphasis on ceramic phase engineering for enhanced fiber performance. Results on zirconia-toughened alumina and zirconia-toughened mullite multifilament fibers demonstrate that targeted compositional design can substantially improve thermal and/or mechanical properties. We will also present current findings on ongoing process developments aimed at expanding the performance envelope and economic viability of next-generation oxide ceramic fiber systems, in particular zirconia toughened mullite fibers.
This presentation closes by highlighting the successful technology transfer between the French company Saint-Gobain and DITF, underlining the importance of know-how transfer for European supply chain independence.

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