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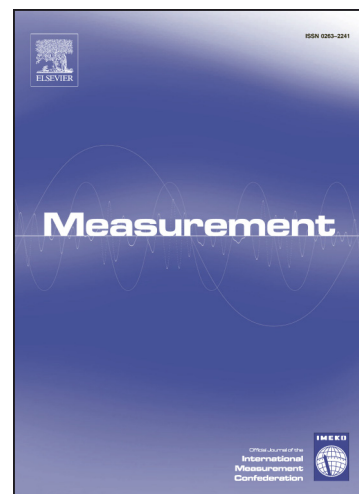
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Regeneration, regenerated gratings and composite glass properties: the implications for high temperature micro and nano milling and optical sensing

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Abstract: A review of regenerated gratings and their application is presented. The relationship between new material perspectives based on the fundamental properties of amorphous structures and composite glass and the implications for practical component development is outlined. These have significant consequences on the high temperature performance possible for photonic components, such as short and long pitch fibre gratings, and call for a broader re-evaluation of fundamental fibre and waveguide design and fabrication to further optimise optical sensing and instrument technologies specifically for harsh environments such as those frequently found in the energy sector, both traditional and new. The work is even more relevant in light of global pursuits into extraterrestrial environments where extreme conditions are routinely present.

Keywords: regeneration; regenerated gratings; annealing; nanomilling; micro-milling; thermal processing; glass memory; viscosity; 3D printing (3–10 keywords separated by semi colons)

1. Introduction

In many reviews and invited presentations by leading proponents of electromagnetic field (e.m.) - immune sensing, optical fibre based measurements of high temperature is often described as one the most outstanding research areas in need of new insight and breakthroughs [1,2]. For example, it impacts sectors spanning the oil and gas industry, the viability of very high power fibre lasers (where even femtosecond fibre gratings in an active fibre can be annealed out [3]), aluminium smelting sectors powered by current generators with high electromagnetic environments, turbine engines in trains, aircraft and space vehicles [4-7], and nuclear industries [8-12] where high temperature monitoring is essential for safe operation. Today, commercial availability of temperature sensors is confined to temperatures below 300 °C; although with no corresponding confidence in performance over time, some companies do offer specialty products operating at much higher temperatures. These include

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