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OORSPRONKLIKE NAVORSING

Deursigtige $MgAl_2O_4$ spinelglas-vervaarding met behulp van 'n enkelfase-vonkplasma-sinteroond (spark plasm sintering furnace) en LiF

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Deursigtige polikristallyne magnesiumaluminaat-spinel is 'n potensiële kandidaat vir die vervanging van die saamgesmelte silikaglas wat in die deursigtige vensters van pantser voertuie en van ruimtevaartuie gebruik word. Hierdie materiaal is goedkoper as ander moontlike materiale en is vermoedelik meer deursigtig.

'n Enkelfase-vonkplasmasinteringsproses (spark plasma sintering/SPS process) is gebruik, met die toevoeging van LiF as sinteringshulpmiddel, om deursigtige magnesiumaluminaat-spinel te vervaardig. Die SPS-proses is vir hierdie doel gekies omdat dit vinnige verhitting en afkoeling moontlik maak, wat kan help om die klein korrelgrootte te handhaaf wat vermoedelik vir optiese deursigtigheid nodig is.

Die vonkplasmasinteringsproses wat gebruik is, het sirkelvormige spinel-monsters opgelewer met 'n gemiddelde deursnit van 20 mm en aanvaarbare transmittansie van ≈72% van die sigbare ligspektrum (vir monsters 3 mm dik). Die meganiese eienskappe van die materiaal was egter swakker as verlang. Veral sorgwekkend was die lae Weibull-modulus van slegs 3.91.

Trefwoorde: sinter, LiF, vonkplasmasinteringsproses, deursigtig

Transparent $MgAl_2O_4$ spinel processing utilising a spark plasma sintering furnace and LiF: Transparent polycrystalline magnesium aluminate spinel is a potential candidate for the replacement of the fused silica glass used in the transparent armour and windows of spacecraft. This material is less expensive than other viable materials and is thought to have better transparency.

A single-stage spark plasma sintering (SPS) process was used, in conjunction with LiF as a sintering aid, to manufacture transparent magnesium aluminate spinel. The SPS process was selected for this purpose as it allows for rapid heating and cooling, which may aid in maintaining the small grain size thought to be required for optical transparency.

The spark plasma sintering process used yielded spinel disk samples with an average diameter of 20 mm and acceptable transmittance of ≈72% of the visible spectrum (for samples 3 mm thick), but the mechanical properties were poorer than desired. Of particular concern was the low Weibull modulus of only 3.91.

Keywords: spinel, LiF, spark plasma sintering, transmittance

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