



Investigation of injection molded short-fiber reinforced CMCs

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Ceramic Injection Molding (CIM) has already found its way into large-scale industrial manufacturing. As further improvement oxide fibers might be embedded into the ceramic matrix to increase mechanical properties especially at elevated temperatures.

Viscosity [Pa.s]

Objectives

- \triangleright Development of feedstocks containing up to 50Vol% powders + fibers
- Specialities of injection molding process for CMC
- Investigation of samples in green + sintered state \triangleright

Materials

- Chopped Al₂O₃ fibers (Nextel 610)
- Al_2O_3 powder (TM-DAR), D50 \leq 200nm
- Binder: Polyethylen, paraffin wax, \triangleright stearic acid, dispersants

1000 Dispersant [mg/m²] at 10 Vol.% Fibe 1.1 -2.2 -3.3 4.4 int [mg/m²] at 15 Vol.% Fibe Disp -1,1 -2,2 =3,3

1000

10000

100

Shear rate [1/s] Above: Viscosity vs dispersant concentration. Best fluidic properties could be reached with dispersant concentrations > 2.2 mg/m².

Results

Viscosity over different fiber content at constant dispersant [3.3 mg / m²]



Above: Viscosity vs fiber content. Flowability depends less strongly on fiber content as expected.

0 Vol.% Fibe 5 Vol.% Fiber 10 Vol.% Fibe 15 Vol.% Fiber 20 Vol.% Fibe



Right: Tensile specimen made of CMC feedstock (green body, above). SEM picture of the same sample showing the high degree of fibre orientation near to the surface (high shear area) and a less degree of orientation in the bulk, i.e. in the low shear area (bottom).

EHT = 8.00 kV Signal A = InLent Date :9 Aug 2016 Mag = 25 X Photo No. = 9476 WD = 18.9 mm

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Viscosity over dispersant at constant fiber content from 10 to 15 [vol.%]