Challenges in the Scaled-up Synthesis of Carbon Aerogel Granulate for Foundry Application

Charlotte Heinrich, Benjamin Ignatzi, Rebekka Probst, Seeni Meera Kamal Mohamed, and Barbara Milow

Deutsches Zentrum für Luft- und Raumfahrt (DLR), Institute of Materials Research, Linder Höhe, 51147, Köln (Germany)
Charlotte.Heinrich@dlr.de

A lot of industrial partners are very interested in exploring new opportunities for the application of aerogel materials. Often tests on an industrial scale are hindered by the lack of large material quantities since scaled-up synthesis has been insufficiently studied so far. Our developments focus on the synthesis of carbon (C) aerogel granulate that is used as functional sand core additives for foundry industry to eliminate casting defects, decrease casting rejection and lower the emission of BTXE gases during casting.[1,2]

C aerogels can be prepared by pyrolysis of organic aerogels like e.g. resorcinol-formaldehyde (RF) aerogels in a furnace under inert gas at elevated temperatures. RF aerogel synthesis takes place in a three-step process consisting of sol-gel reaction, ageing of the gel and drying. In the drying step, the solvent is removed completely from the gel while maintaining the porous network structure. For the use as additives for foundry applications, aerogel granulate of defined grain size is required according to safety regulations and for better handling. Therefore, monolithic aerogels have to be ground and screened prior to application.

We address the challenges of transferring the synthesis of C aerogel granulate from laboratory to pilot plant scale production. Our batch production yields about 15 kilogram of RF aerogel, considering the low density of 0.31 g/cm³ this equals 48 L. Further processing includes granulation and carbonization, elevating the level of development with respect to foundry needs. Product quality was determined by measuring density, surface area, particle size distribution and micro-structural appearance in SEM pictures. Practical applicability of the C aerogel granulate has been tested in a demanding case of iron casting.

Acknowledgements:
This work was done in the context of the project 03ET1527 supported by the Federal Ministry for Economic Affairs and Energy (BMWi).

References:
[1] Ratke L., Milow B., Gießereikerne mit verbesserten Eigenschaften II, Patent DE102008056842A1
[2] Meyer E., Barowski A., Schestakow M., Milow B., Ratke L., Aerogele als Sandkernadditive zur Verbesserung der Gussteilqualität, GIESSEREI 103, 2016, 40-45