Quantitative analysis of silica aerogel-based thermal insulation coatings - DTU Orbit (03/01/2019)

Quantitative analysis of silica aerogel-based thermal insulation coatings

A mathematical heat transfer model for a silica aerogel-based thermal insulation coating was developed. The model can estimate the thermal conductivity of a two-component (binder-aerogel) coating with potential binder intrusion into the nanoporous aerogel structure. The latter is modelled using a so-called core–shell structure representation. Data from several previous experimental investigations with silica aerogels in various binder matrices were used for model validation. For some relevant cases with binder intrusion, it was possible to obtain a very good agreement between simulations and experimental data with shell thickness and/or thermal conductivity of the shell as adjustable parameters. However, the experimental data was not sufficiently detailed to allow a separation of the effects of the two parameters. In the ideal case of no aerogel binder intrusion, a comparison with a coating containing intact hollow glass or polymer spheres showed that silica aerogel particles are more efficient in an insulation coating than hollow spheres. In a practical (non-ideal) comparison, the ranking most likely cannot be generalized. A parameter study demonstrates how the model can be used, qualitatively, to get an indication of the effect of important model parameters on the thermal conductivity of an insulation coating. With relevant data available for service life exposure conditions and raw material costs, the model can also be used as an optimization algorithm.

General information
State: Published
Organisations: Department of Chemical and Biochemical Engineering, CHEC Research Centre
Contributors: Kiil, S.
Pages: 26-34
Publication date: 2015
Peer-reviewed: Yes

Publication information
Journal: Progress in Organic Coatings
Volume: 89
ISSN (Print): 0300-9440
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): SJR 0.844 SNIP 1.288
Web of Science (2017): Impact factor 2.955
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 2.89 SJR 0.852 SNIP 1.335
Web of Science (2016): Impact factor 2.858
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 2.84 SJR 0.857 SNIP 1.384
Web of Science (2015): Impact factor 2.632
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 2.8 SJR 0.997 SNIP 1.585
Web of Science (2014): Impact factor 2.358
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 2.58 SJR 1.03 SNIP 1.642
Web of Science (2013): Impact factor 2.302
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): CiteScore 2.39 SJR 1.048 SNIP 1.83
Web of Science (2012): Impact factor 1.848
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1