Feasibility study of a novel aerogel-based thermally sprayed coating

ABSTRACT

Aerogels are sol-gel derived nanostructured ceramics with fascinating physical properties to the extent that they are sometimes recognised as a new state of matter. The lightest aerogel is now graphene aerogel followed silica aerogel, which is, still the best thermal insulator ever existed. In the aerospace arena or even in the most aerogel dominated industry which is oil and gas, the quest for ever-more efficient systems is largely pursued by minimising the weight and space without compromising the overall performance. As far as thermal insulation is concerned, silica aerogel has always been attributed with the notion of superinsulation due to its superior heat resistance compared to conventional materials. Innovative solutions have been brought forward thereby aerogel-based flexible glass-wool blankets and aerogel-doped paints have been developed and commercialised. This paper proposes a novel method of application wherein silica aerogel was thermally sprayed using atmospheric plasma spraying to produce a micro-thick coating on glass, for instance. Being a preliminary study, four pivotal spraying parameters were taken into account and trials were made by altering them in a systematic manner to obtain an adhering coating. The aerogel-based plasma sprayed coating formed had a maximum cross-sectional thickness ranging from 77.9 to 132.0 μm with spraying parameters of power, carrier gas flow, plasma gas (Ar+H2) and nozzle diameter of 25 kW, 8.1 slpm,(45+5) slpm and 4 mm respectively.

Keyword: Aerogel; Aerospace; Coating; Plasma spray