Currently, various grades of ceramic fiber papers are applied as insulation materials for applications above 1000°C. On the one hand, the variations in chemical composition of ceramic fiber papers lead to different temperature resistance. Thus, ceramic fiber papers based on alkaline earth silicate (AES) are resistant to operating temperatures up to 1200°C, while ceramic fiber papers based on aluminum oxide (AO) can withstand 1600°C. On the other hand, the various chemical compositions lead to significant differences in material costs of ceramic fiber papers. The costs of ceramic fiber papers based on aluminum oxide are typically about 20 times the costs of ceramic fiber papers based on alkaline earth silicate. A sharp increase in material cost can be observed with the increase in the temperature resistance requirement.

In view of the prior art, the present disclosure serves to provide ceramic fiber papers with improved thermal insulation capability and temperature resistance at reduced costs.

The present inventors surprisingly found that this problem can be solved by incorporating aerogel into ceramic fiber papers after the fiber papers have been formed. This can be achieved by preparing an aerogel composition comprising an aerogel powder and an organic solvent and injecting or impregnating it into the fiber paper. Due to this approach, the use of binders can be reduced or even entirely avoided, while still obtaining an excellent attachment of the aerogel powder to the fibers of the fiber paper.

Thus, in a first aspect, the present disclosure relates to a method for the preparation of a composite article comprising aerogel particles and ceramic fibers, the method comprising:
- providing a fibrous article comprising ceramic fibers,
- providing an aerogel composition comprising an aerogel powder and an organic solvent,
- combining the fibrous article and the aerogel composition, and
- partially or completely removing the organic solvent to obtain the composite article.

In another aspect, the present disclosure furthermore relates to a composite article obtainable by the method as disclosed herein.

In addition, the disclosure relates to a composite article comprising aerogel particles and ceramic fibers, wherein the composite article is obtainable by injecting or impregnating an

aerogel composition comprising an aerogel powder and an organic solvent, and optionally inorganic opacifiers and/or mineral fillers, into a fibrous article comprising ceramic fibers, and partially or completely removing the organic solvent to obtain the composite article.

In still a further aspect, the present disclosure relates to a composite article comprising aerogel particles and ceramic fibers, wherein one or more of the following requirements (i) to (vi) are fulfilled:

(i) the composite article contains less than 15% by weight organic compounds;

(ii) at least 50% of the fibers in the composite article have a length of 5 mm or more;

(iii) the composite article contains less than 10% by weight binder;

(iv) the composite article exhibits a total weight loss in thermogravimetric analysis (TGA) when being heated in a nitrogen atmosphere from 30°C to 1100°C with a temperature increase of 10 °C/min of less than 35% by weight;

(v) the weight ratio of the one or more aerogels to the one or more fibers (aerogel/fiber) in the composite article is 1:8 or higher;

(vi) the composite article has a burn-through time of 60 minutes or more, wherein the burn-through resistance is determined using the composite article in the form of a DIN A4 sheet with a thickness of 1 to 3 mm and treating the composite article at the centre of its first major surface with a flame having a temperature of 1400°C, using a soldering torch, wherein the burn-through time is the duration from start of the flame treatment until the centre of the second major surface reaches a temperature of 1000°C;

BRIEF DESCRIPTION OF THE FIGURES

Figure 1: Aerogel-incorporated ceramic fiber paper (raw paper thickness 1 mm) (Example 1-1) a) top view; b) side view

Figure 2: Aerogel-incorporated ceramic fiber paper (raw paper thickness 3 mm) (Example 1-3) a) top view; b) side view

Figure 3: Soldering torch test setup

Figure 4: Blank ceramic fiber paper (raw paper thickness 2 mm) after 20 sec flaming; a) front view; b) back view