Supplementary Material (ESI) for Journal of Materials Chemistry

Supporting information:

Sintering of core-shell Ag/glass nanoparticles: Metal percolation at the glass transition temperature yields metal/glass/ceramic composites

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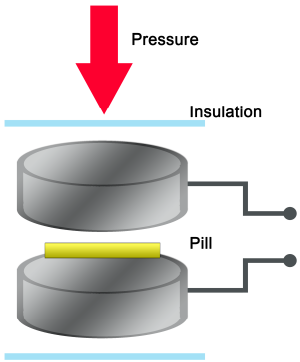

Fig. S1. Sketch of the conductivity measurements of the pressed bulk pills

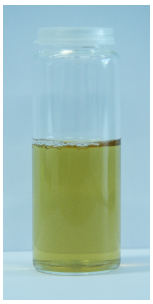

Fig. S2 A yellow appearing dispersion of Ag/SiO_2 nanoparticles in water was made by adding 1 mg particles to 10 g water with 0.1 wt% Disperbyk-190 (BYK-Chemie GmbH) and ultrasonification for 5 minutes.

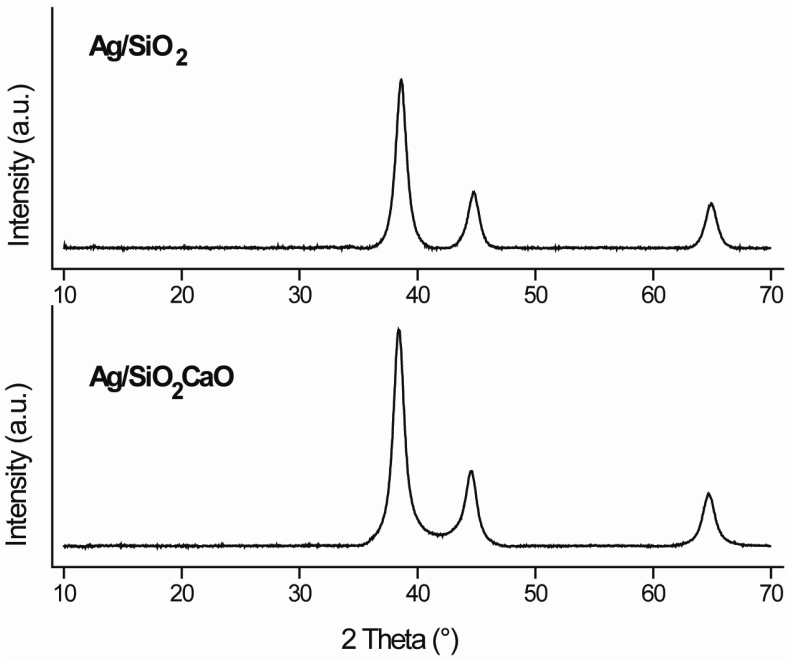

Fig. S3 X-ray diffractograms of the as prepared nanopowders showing only the silver peaks.

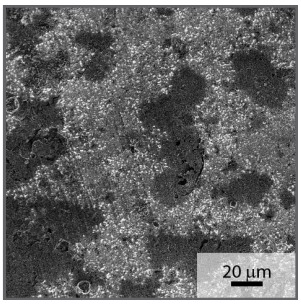

Fig. S4 A silver silica composite was produced by mixing silver nanoparticles (Aldrich-Fine Chemicals) and flame made silica nanoparticles (3:2 weight ratio), subsequently pressing the resulting powder into quadratic bulk pills by using an uni-axial press (Maassen GmbH, 54MP250) at 245 MPa and sintering the pill at 1000°C for 30 minutes. The scanning electron micrographs showed strongly segregated silver and glass phases (bright phase = silver, darker phase = silica), which explained the observed position dependent conductivity and underlined the necessity of using a homogenous starting material.

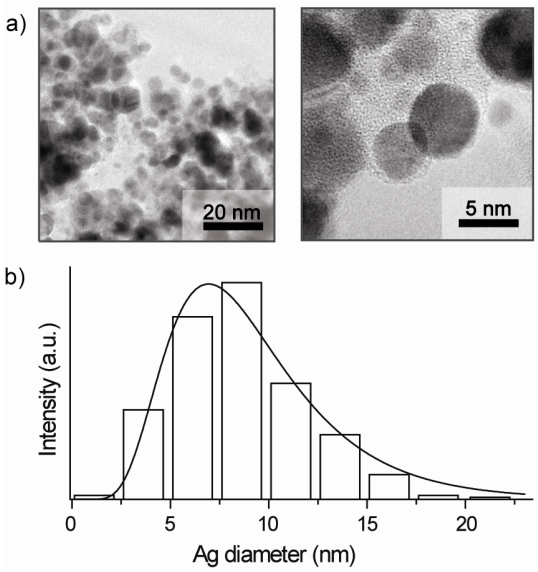

Fig. S5 Ag/SiO_2 nanoparticles made by flame spray synthesis: a) Transmission electron micrographs showing the silver-core/silica-shell structure b) Silver diameter distribution evaluated by silver diameter counting fitted to a log-normal distribution with a number based geometric mean of around 8nm.

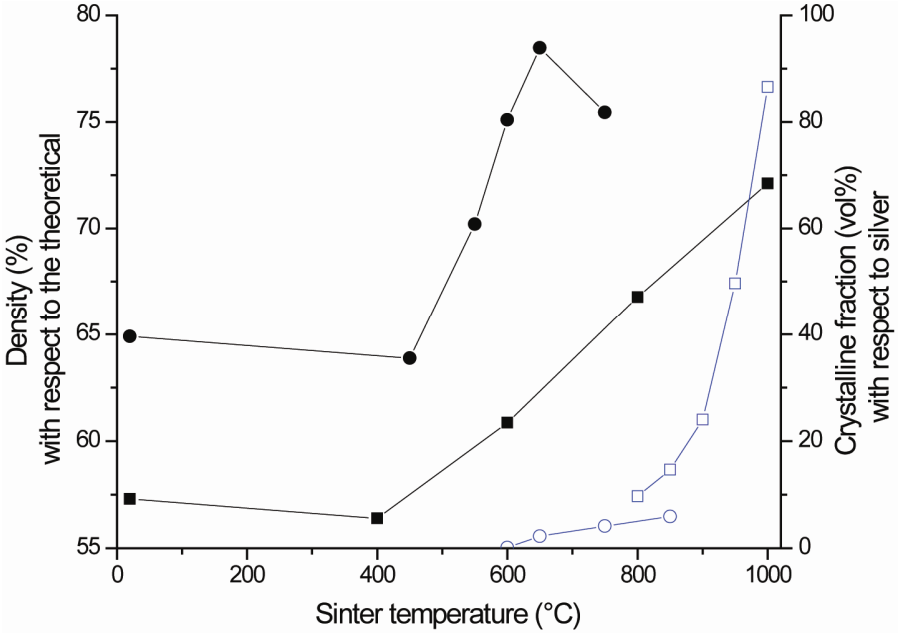

Fig. S6 Densities of the bulk pills with increasing sinter temperatures showing a clear increase (black squares = Ag/SiO_2, black dots = Ag/SiO_2CaO). The blue lines show the crystalline fraction (vol%) of the silica phase evaluated by Rietveld refinement (open blue squares = Ag/SiO_2, open blue dots = Ag/SiO_2CaO).

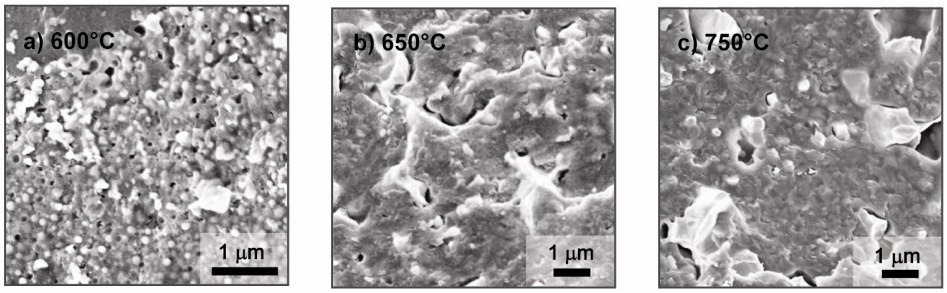

Fig. S7 Scanning electron micrographs of the heat treated Ag/SiO_2CaO composites: a) Silver spheres and strains b) Formation of a percolating silver network c) Growth of the silver network.