Fluid/Fibre interactions and the conductivity of inkjet printed Ag on textile substrates

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Textiles present unique material properties in terms of their flexibility and conformability, which are ideal for applications in wearable technology. However, the practical use of textiles as substrates for printed electronics and functional devices presents considerable challenges because of their considerable roughness and intrinsic porosity when compared with polymer films. This is particularly true for inkjet printing where printed drop dimensions are on a scale similar to that of yarns used during textile manufacturing processes, e.g. weaving and knitting. Here we present a study of the use of inkjet printing of a commercial silver nanoparticle ink on plain woven polyester fabrics. Reduced ink drop spacing, increased surface hydrophobicity and in a sintering per layer technique gives enhancement on their electrical performance. A resistance of 0.11 ± 0.02 ohm within two woven yarn repeat units is reached through 5 layers of printing. To visualize and understand their different electrical conductivity mechanisms, computed X-ray micro tomography has been used to characterize silver nanoparticle ink transport and deposition through the fabric fibre architecture. The corresponding trends found between tomography computed and probe measured electrical resistance proves its feasibility on comprehensive characterizing conductive ink deposition on textiles.