# Processing of Solar Absorber Coatings From Nanocrystal Dispersions

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Coatings from nanoparticle and nanocrystal dispersions offer a low-cost means to create thin film absorber layers for solar cells. Relatively thick coatings (~ 1-3 μm) are required for solar absorbers; therefore, drying induced stresses and cracking are a particular challenge. While making small (laboratory-scale) solar cells, this challenge is avoided by multiple applications of the dispersion using methods such as spin-coating or dip-coating. These methods are not suitable for large-scale high-throughput manufacturing and new approaches must be developed. Towards this end, we have developed a potentially high-throughput method to create dense, crack-free nanocrystal coatings from the new solar absorber material, copper zinc tin sulfide (CZTS). Aerosol jet printing is used to create a continuous nanocrystal coating from CZTS dispersions. However, the as-coated microstructure is very porous due to in-line evaporation of the aerosol mist droplets and must be compacted further. The as-deposited porous coatings were collapsed to a denser coating using either a roller or a hydraulic press. Coatings made under different compression pressures were annealed at 500-600 $^{o}$C in sulfur vapor to understand the influence of coating density on the final film morphology. By controlling the individual steps in the coating process, including deposition, compaction and sintering, nanocrystal-based coatings can be converted into large-grained polycrystalline layers in a potentially high-throughput process suitable for continuous production.