



Supporting Information

for

Gold and silver dichroic nanocomposite in the quest for 3D printing the Lycurgus cup

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TEM micrographs of Ag and Au nanoparticles, SAXS data, pictures of the Lycurgus cup under different illumination, transmission and reflectance spectra of AuNP/AgNP @PVA nanocomposites

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Supporting Information File 2: Video about the dichroic AgNP@PVA and 3D printed cups
(Music: Gigue From 3rd Cello Suite, Exzel Music Publishing (freemusicpublicdomain.com)
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Supporting Information File 2: Video S2 AgNP@PVA 3D printed cup under different illumination systems.

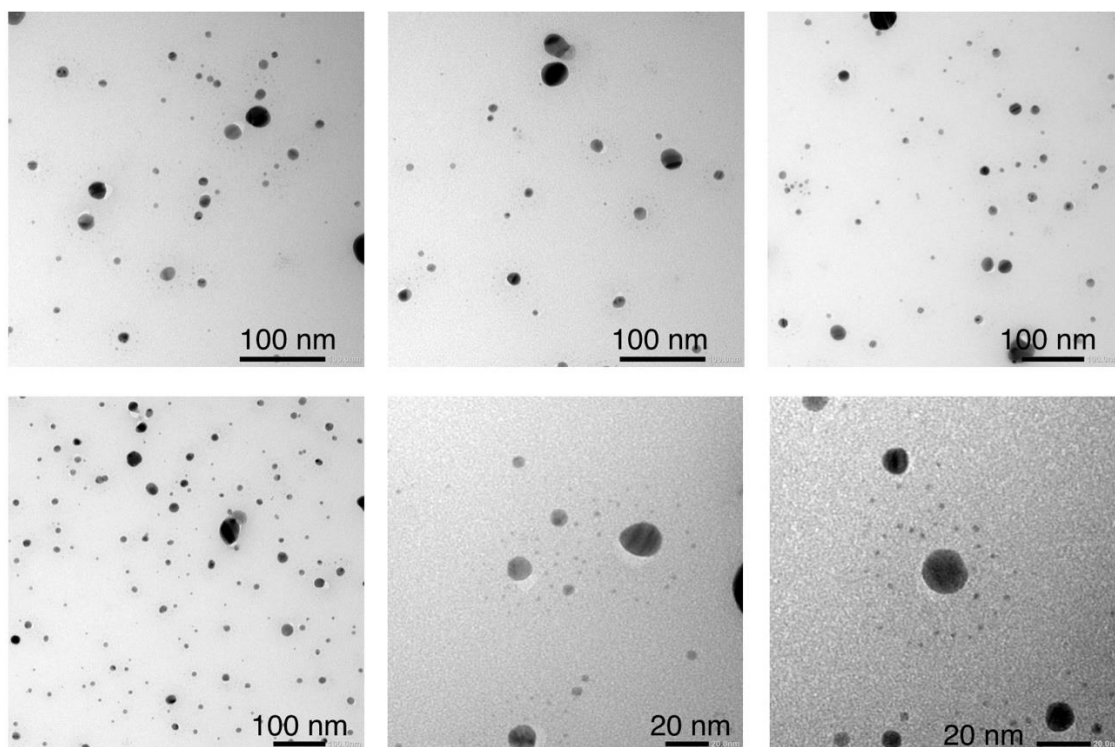
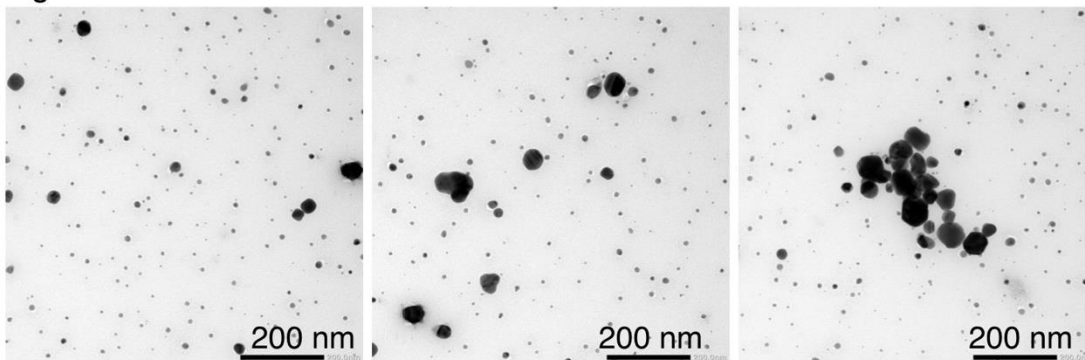


Figure S1. TEM pictures of the dichroic AgNP.

AgNP



Dissolved AgNP@PVA

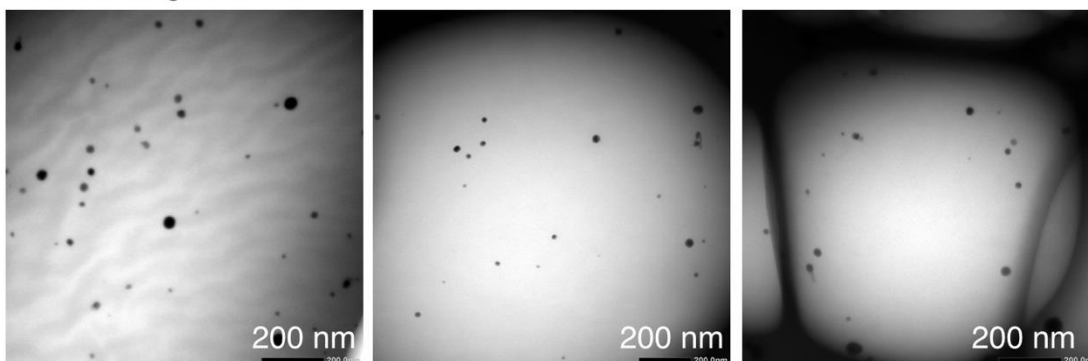


Figure S2. TEM micrographs of dichroic AgNP solution (top), and after dissolving the AgNP@PVA in water (bottom).

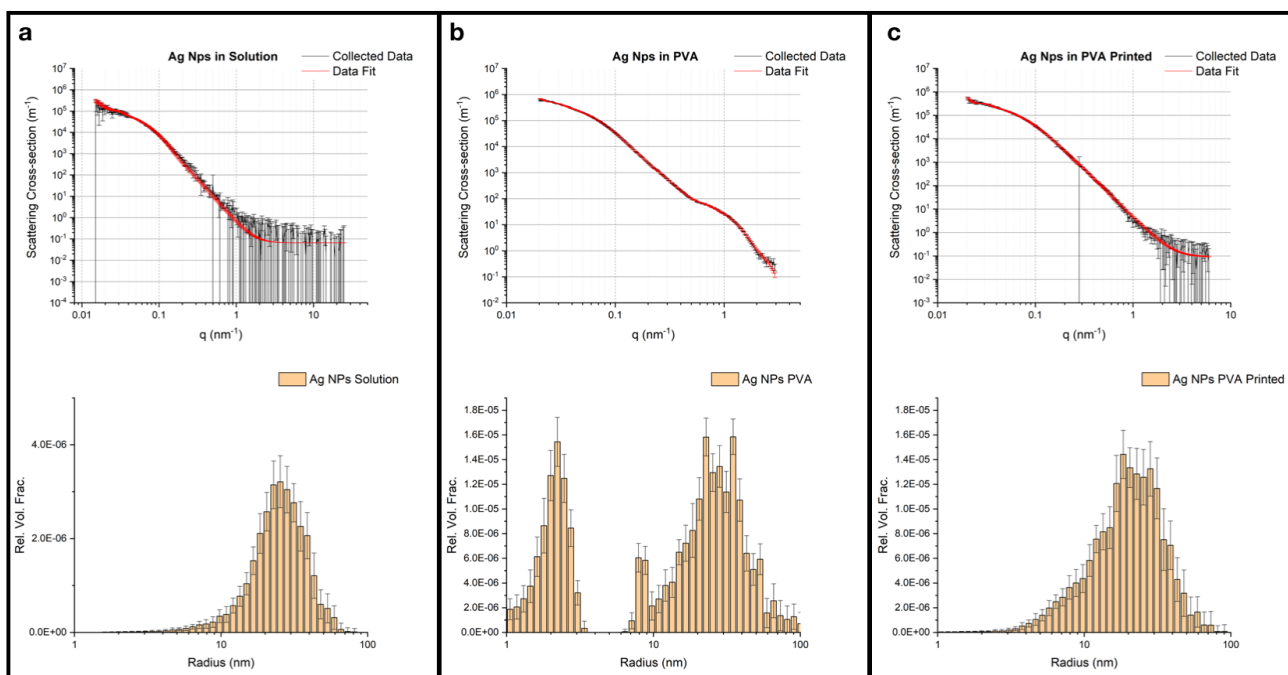


Figure S3. SAXS of a) AgNP in solution, b) AgNP@PVA and c) 3D printed AgNP@PVA. We speculate that the smaller particles detected in the AgNP@PVA sample are due to the phase separation of PVP in PVA. When the solution of AgNP, which contains an excess of PVP is mixed with the PVA solution, the temperature of evaporation for making the solid plastic, is only 70 °C, which is way lower than its melting temperature. Once the material is printed at 215 °C (above the PVP melting point), the two polymers mixes and the smaller PVP particles are no longer detectable.



Figure S4. The 3D printed AgNP@PVA dichroic material under sunlight, reflected light on the left and transmitted light on the right.

Ambient illumination



Flashlight LED



Figure S5. Picture of the Lycurgus Cup under ambient (museum) illumination on the left, and picture taken with the iPhone 7 flash on the right. The flashlight clearly reflects a green colour with respect to the ambient light which makes the cup reflect a more brownish colour. Pictures taken and used with permission from Kirsty Milligan (Twitter: @MilliganKirsty1)

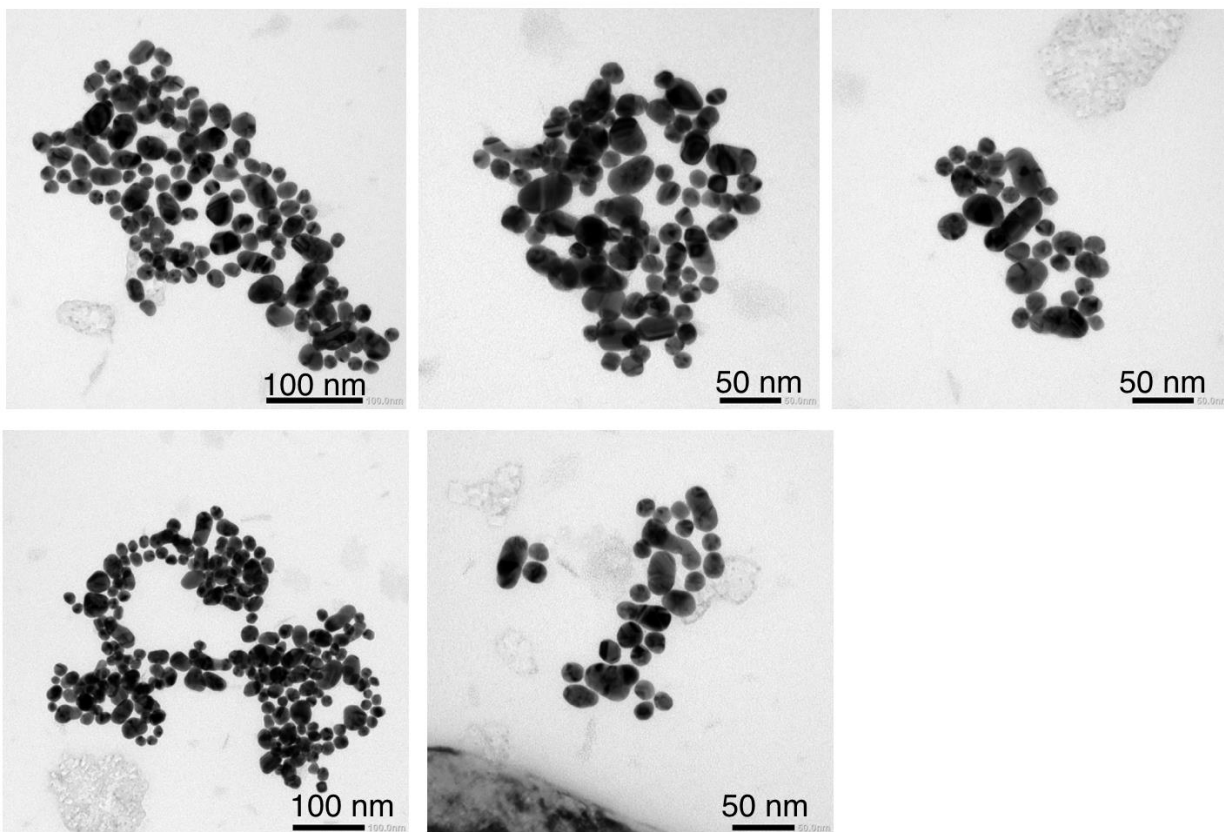


Figure S6. TEM micrographs and particle analyses of the AuNP solution. The AuNP have a peak distribution around 16-20 nm and are mostly spherical (ratio 1.1).



Figure S7. Dichroic AgNP@PVA on the left and AuNP@PVA on the right. Transmitted light on top and reflected light on the bottom.

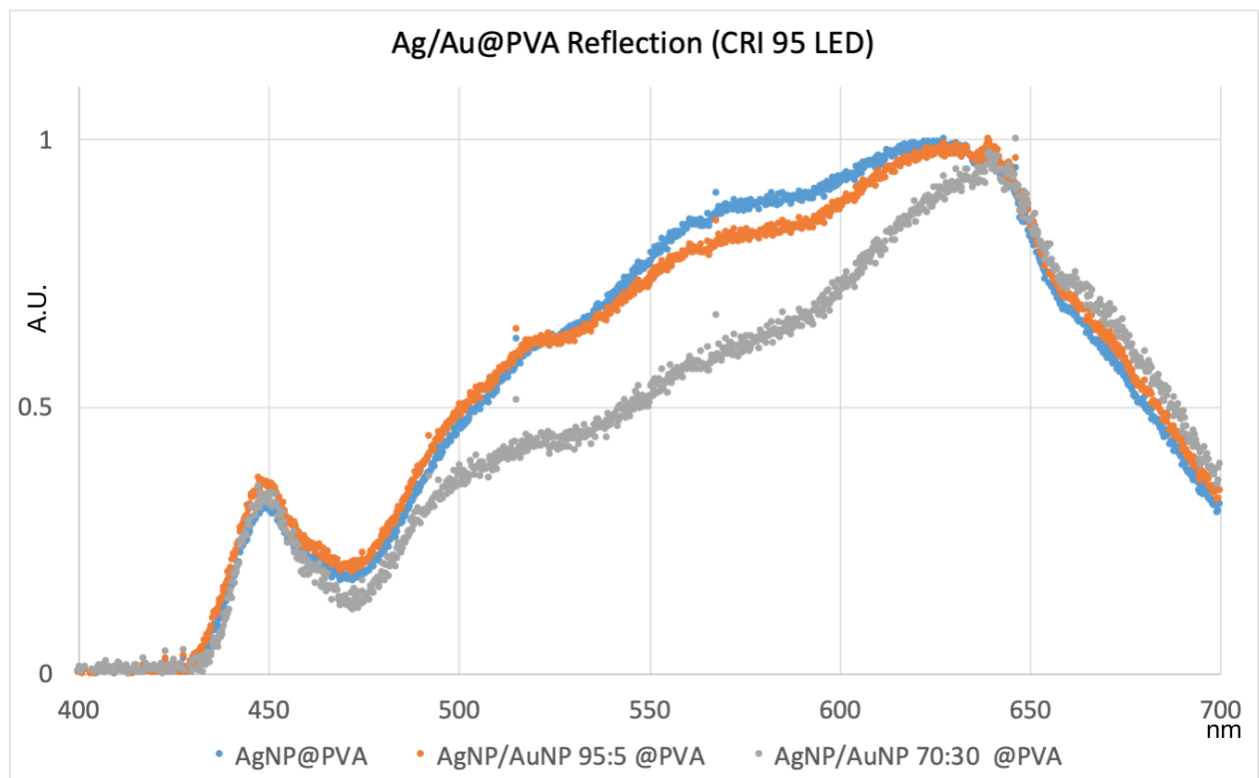
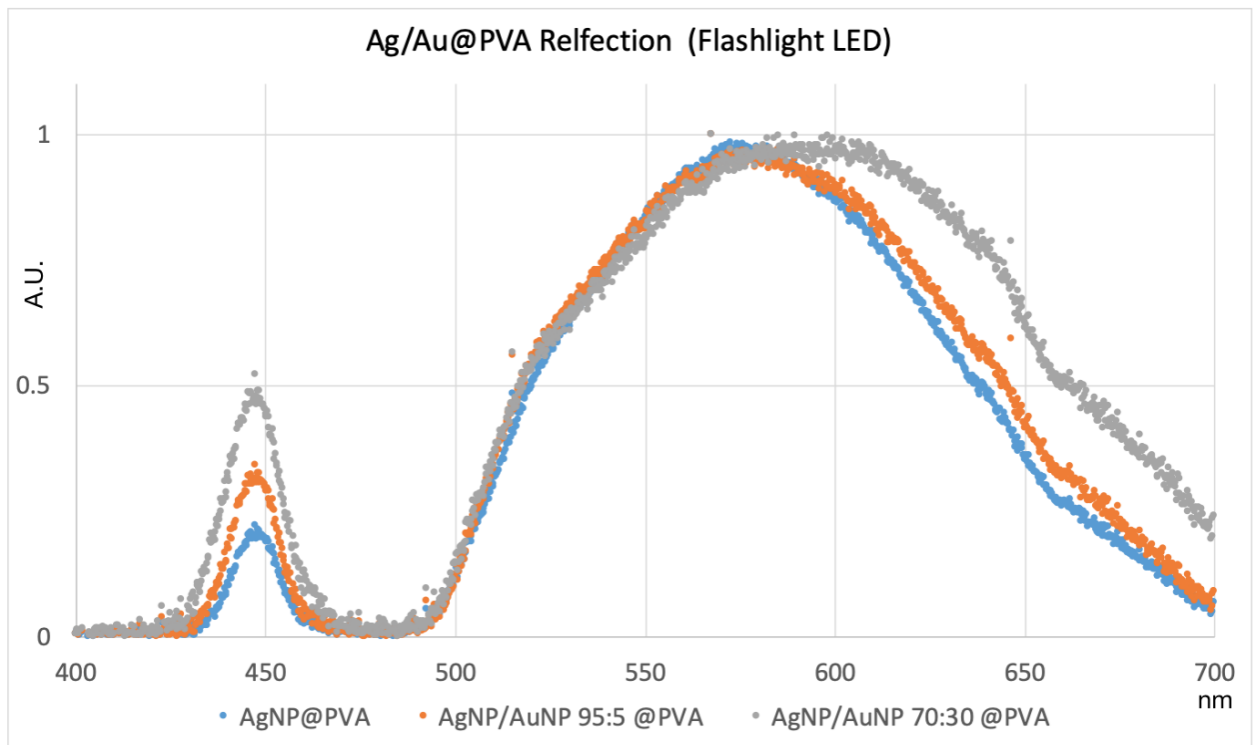


Figure S8. Reflectance spectra of 3D printer mixed AgNP/AuNP @PVA materials. In both illumination cases the reflected light shift to red with the increasing of the AuNP in the material.