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A study on the wetting behaviour of the ink and the wettability of the substrate starts by using Young's equation (1) and describes the relation between the surface free energy of the substrate (γ_s), the surface tension of the solution (γ_l), the solid-liquid interfacial energy (γ_{sl}) and the contact angle between solution and substrate (θ):

$$\gamma_s = \gamma_{sl} + \gamma_l \cos\theta \quad (1)$$

To understand the relation between the composition of the ink, the cleaned substrate and the wetting/wettability, we determined the total surface tension of the YBCO solution and of the cleaned $SrTiO_3$ substrate and also made a distinction between the dispersive and polar component for both interfacial energies, making a distinction between van der Waals and polar (dipole/dipole and hydrogen-bonding) interactions (2) (Table 3).[48]

$$\gamma = \gamma^D + \gamma^P \quad (2)$$

The dispersive and polar component of the solid substrate can be determined using the Owen-Wendt method by measuring the contact angle between the substrate and solvents with a well-known surface tension.[49] Using a solution which exhibits only a dispersive component (3), like diiodomethane, the dispersive component of the solid can be calculated directly from the contact angle of the solution with the solid (4).

$$\gamma_l = \gamma_l^D \quad (3)$$

$$\gamma_s^D = \frac{\gamma_l}{4}(\cos\theta + 1)^2 \quad (4)$$

For the polar component, a solution exhibiting both components is necessary: here water can be used. Based on formula (5), we can calculate the polar part of the surface free energy from the contact angle between the substrate and the water.

The total surface tension of the solid is then the sum of the polar and the dispersive component, i.e. 77.9 mN/m in case of STO as substrate (Table 3).

$$\sqrt{\gamma_s^D \gamma_l^D} + \sqrt{\gamma_s^P \gamma_l^P} = \frac{\gamma_l(\cos\theta + 1)}{2} \quad (5)$$

The total surface tension of the ink can be extracted from a pendant drop measurement (67.9 mN/m for YBCO ink). The dispersive component can be determined by measuring the contact angle of the ink with a piece of Teflon which does not possess a polar component. We found a contact angle of 111.3° +/- 0.5°. With the knowledge of the surface tension of Teflon (18 mN/m) and the contact angle made by the solution, formula (5) can be written as followed to calculate the dispersive component of the solution:

$$\gamma_l^D = \left(\frac{\gamma_l^2}{72}\right)(\cos\theta + 1)^2 \quad (6)$$

The polar component is then the difference of the total surface tension and the dispersive component.