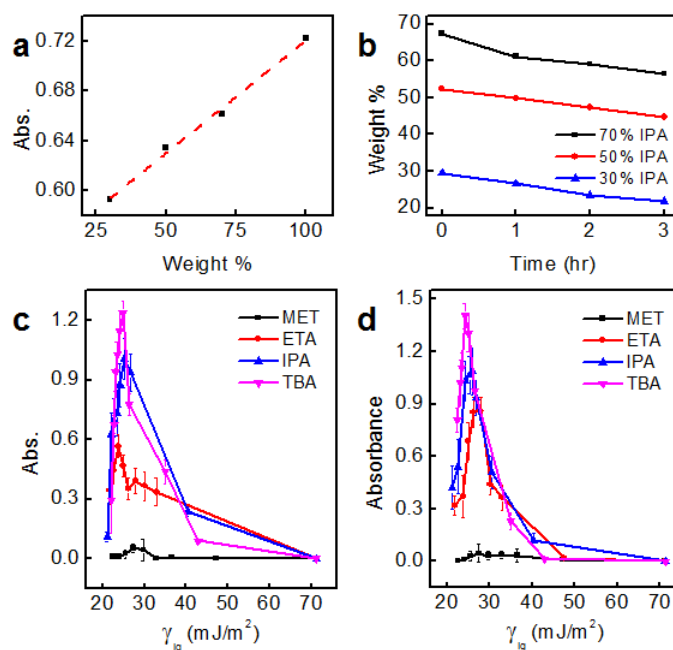
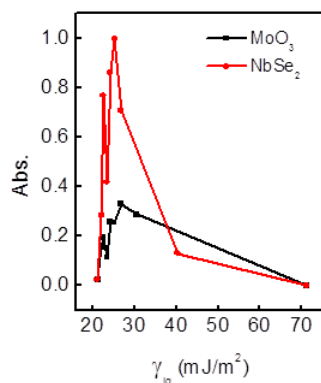


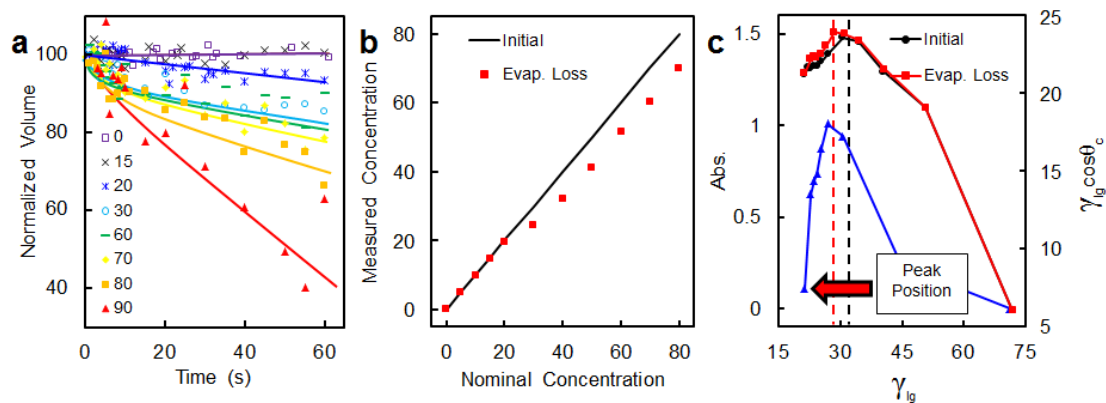
Supplementary Figure S1 | SEM image of the exfoliated materials. (a) graphene flakes. (b) MoS₂ flakes. Scale bars are 500 nm



Supplementary Figure S2 | Solvent concentration change during sonication exfoliation. (a) Absorbance calibration curve (at 1200 nm) of IPA-water mixture normalized with pure water. (b) Concentration change of 70, 50 and 30 w% IPA solutions over time. We observed that after 3 hours of sonication, the concentrations are decreased from 67 w% to 56 w%, 52 w% to 44 w% and 29 w% to 21 w%. (c) Absorbance of exfoliated graphite and (d) MoS₂ before solvent evaporation correction. Using the evaporation profile above, surface tension was re-calculated to obtain the corrected graphs in Figure 3c,f.



Supplementary Figure S3 | Absorbance of exfoliated MoO₃ and NbSe₂ in water-IPA co-solvent system. The absorbance of the exfoliated materials is plotted against surface tension, exhibiting a similar trend to that of graphite and MoS₂. Absorption peaks around 25-33 mJ/m² for MoO₃ and around 22-28 mJ/m² for NbSe₂ were found.



Supplementary Figure S4 | Evaporation effect on contact angle measurements and surface energy determination. (a) Droplet volume change over time for various water-IPA mixtures. The corresponding labelled number is the IPA concentration. The contact angle measurement was typically taken around 10-15 sec. Solid lines are guide to the eye. (b) Concentration profile of water-IPA mixture after a similar evaporation loss in a Petri dish. (c) The corrected $\gamma_{lg}\cos\theta_c$ vs. γ_{lg} plot after considering the evaporation loss shows a shift of the peak toward left.

Supplementary Note 1

It is noted that the peak exfoliation position is shifted to the left compared to the peak surface energy plot (Fig. 2c,f). This shift can be largely attributed to the solvent evaporation during the contact angle measurements. Due to the relatively small liquid droplets and large surface to volume ratio, this evaporation loss can be quite significant especially for solvents with higher alcohol concentration. In general, this evaporation loss lowers the alcohol concentration and results in an overestimation of the expected contact angle for the nominal solvent composition. In the other words, for a contact angle measured, the actual solvent concentration is less than the nominal concentration.

To evaluate the impact of the solvent evaporation during the contact angle measurement, we have used IPA/water systems as an example and measured the liquid droplet volume change over a 1-minute period of contact angle measurement. An evaporation loss as large as ~60 % was observed for high alcohol concentration solvents (Supplementary Figure S4a). For a typical contact angle measurement takes ~10-15 s, there is a volume loss of ~10-20 % for high alcohol concentration solvents.

Since it is difficult to determine the exact solvent composition in such a small droplet (~ 1 mm diameter) during the contact angle measurements, we tried to replicate the evaporation profile in a petri dish with larger amount of solvents, and determined the solvent compositions after the evaporation loss of a similar volume percentage (Supplementary Figure S4b). Based on the corrected solvent composition, we can recalculate γ_{lg} and $\gamma_{lg}\cos\theta_c$ to produce a corrected plot of $\gamma_{lg}\cos\theta_c$ vs. γ_{lg} , which shows a left shift of the peak position (Supplementary Figure S4c). The initial peak position at ~32 mJ/m² shifts to ~29 mJ/m², which is closer to the observed exfoliation peak (Fig. S4c, blue line).