Electronic Supplementary Material (ESI) for Nanoscale.

Supplementary Information: Nanoscale

Dispersion and characterization of arc discharge single-walled carbon nanotubes – towards conducting transparent films

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I. EDS analysis of the catalyst material

EDS was performed on the residue of the TGA in a Jeol JSM-7500FA scanning electron microscope. Fig. S 1 and S 2 show the elemental composition of the residue of both HiPCO and Iljin SWCNTs. It has to be mentioned that the oxygen content has to be contributed to oxidation of the metallic catalyst particles during the TGA under air. These two spectra allow an estimate of the average catalyst composition due to the macroscopic amount of material used in the TGA (several milligrams). The catalyst of HiPCO SWCNTs only consists of iron – in good accordance to the product data sheet – whereas the spectrum for Iljin SWCNTs reveals cobalt, nickel and iron as catalyst. The EDS of individual catalyst particles in HR-TEM measurements (compare Fig. 2, main article) revealed that the ratio of these metals varies throughout the particles, which might be ascribed to the use of milled metal particles instead of a homogeneous alloy. We furthermore detected individual silica particles within the pristine material from Iljin Nanotech which can most likely be contributed to a chromatographic purification step using a silica loaded column.

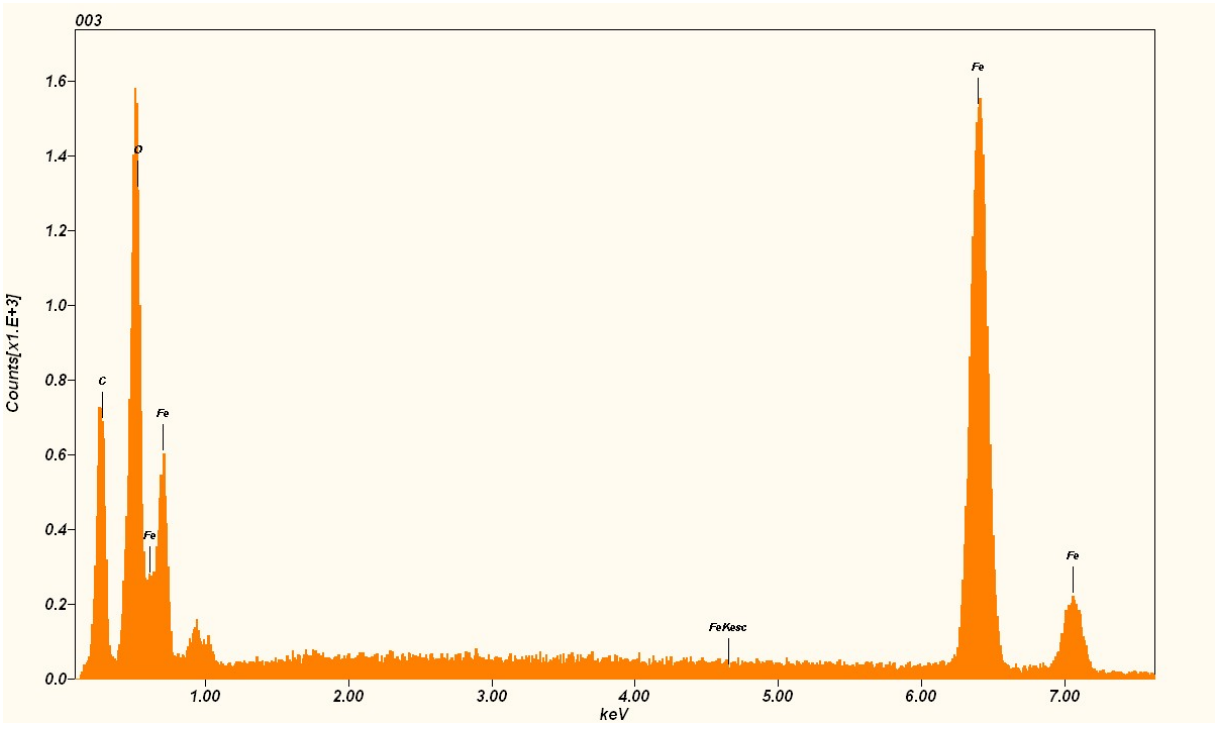

Figure S1 X-ray fluorescence spectrum of the residue from TGA of HiPCO SWCNTs. The acceleration voltage was set to 15 keV.

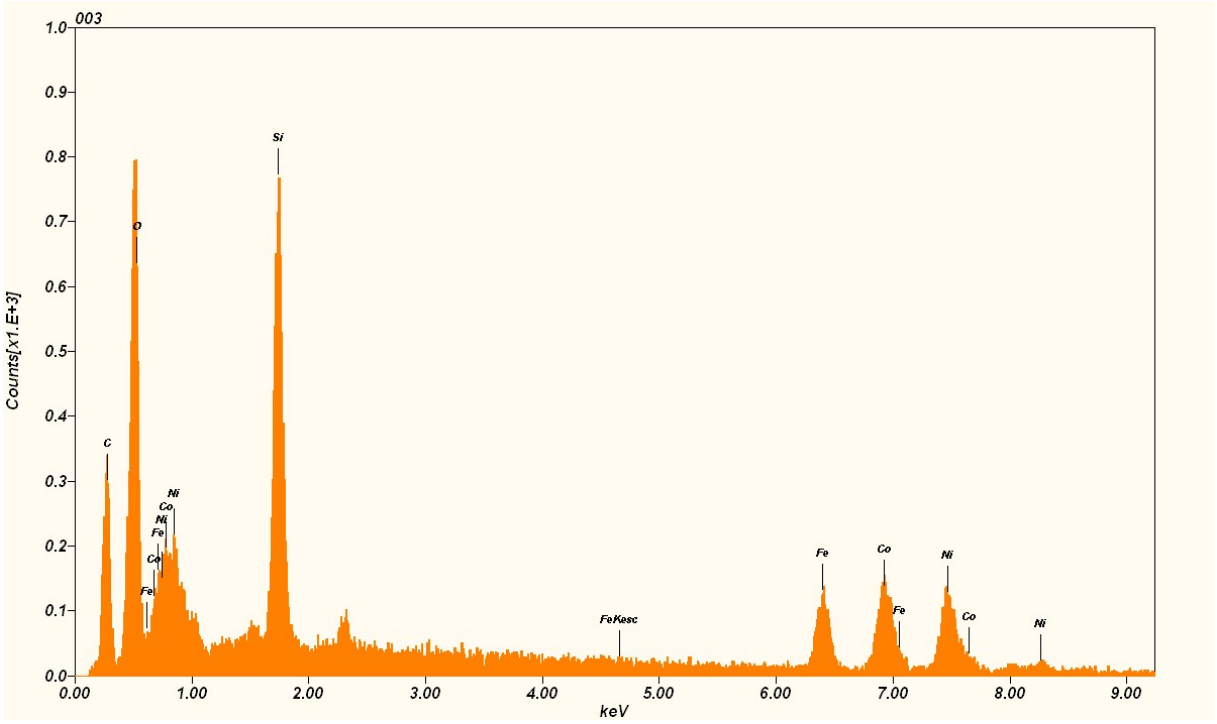

Figure S2 X-ray fluorescence spectrum of the residue from TGA of Iljin SWCNTs. The acceleration voltage was set to 15 keV.

II. Extended UV-Vis/NIR spectrum of an Iljin SWCNT dispersion in CHP

It is also possible to record a spectrum for CHP extended into the NIR region, including the S_{11} transitions. Due to the fact that surfactant solutions feature strong absorption bands in this region of the spectrum, it was impossible to detect any features in the corresponding spectra. CHP also shows a strong absorption between 1600 and 1800 nm (Fig. S 3). It becomes obvious that the light intensity for recording nanotube spectra is very poor in this range according to the Lambert-Beer law, leading to extreme statistical noise in determining the quotient I/I_0. Opening the aperture slit of the spectrometer to maximum avoids, on one hand, this problem, but results, on the other hand, in poorer wavelength resolution including slight shifts of the peaks – compare the red graph in Fig. S 4. Still, the S_{11} transitions of Iljin SWCNTs are discernable in the range between 1500 and 2000 nm, which is – to the best of our knowledge – the first time for a low-noise detection of S11 transitions in this particular diameter range.

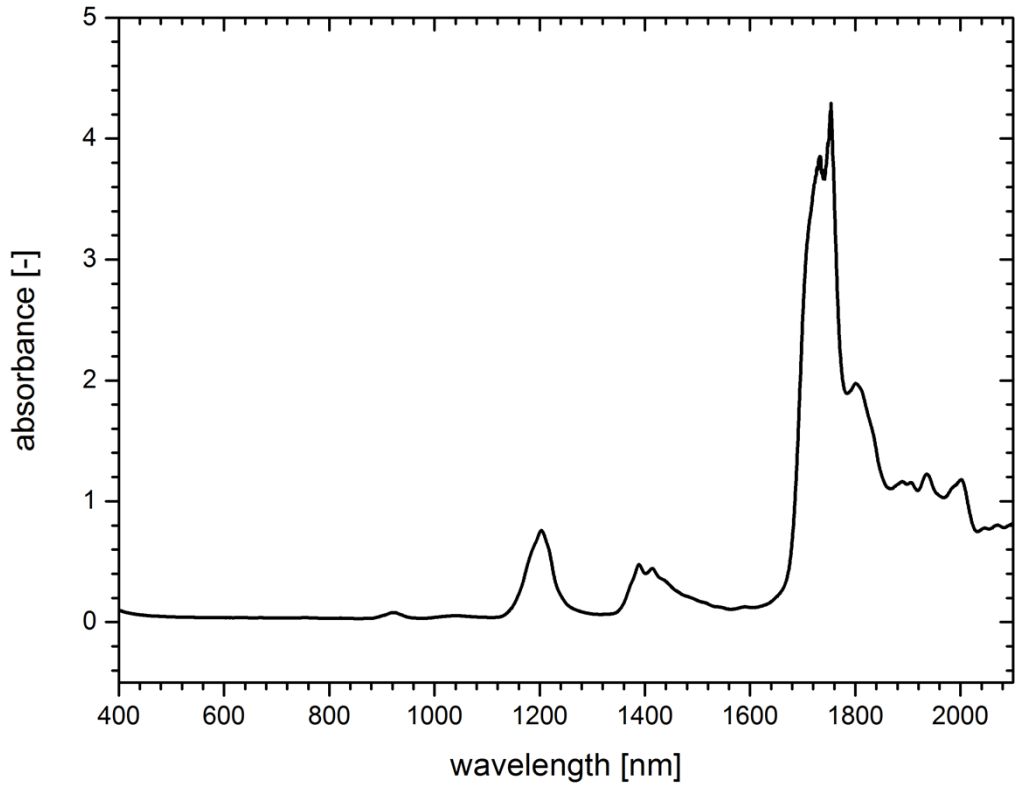

Figure S3 UV-Vis/NIR spectrum of pure CHP (air as reference).

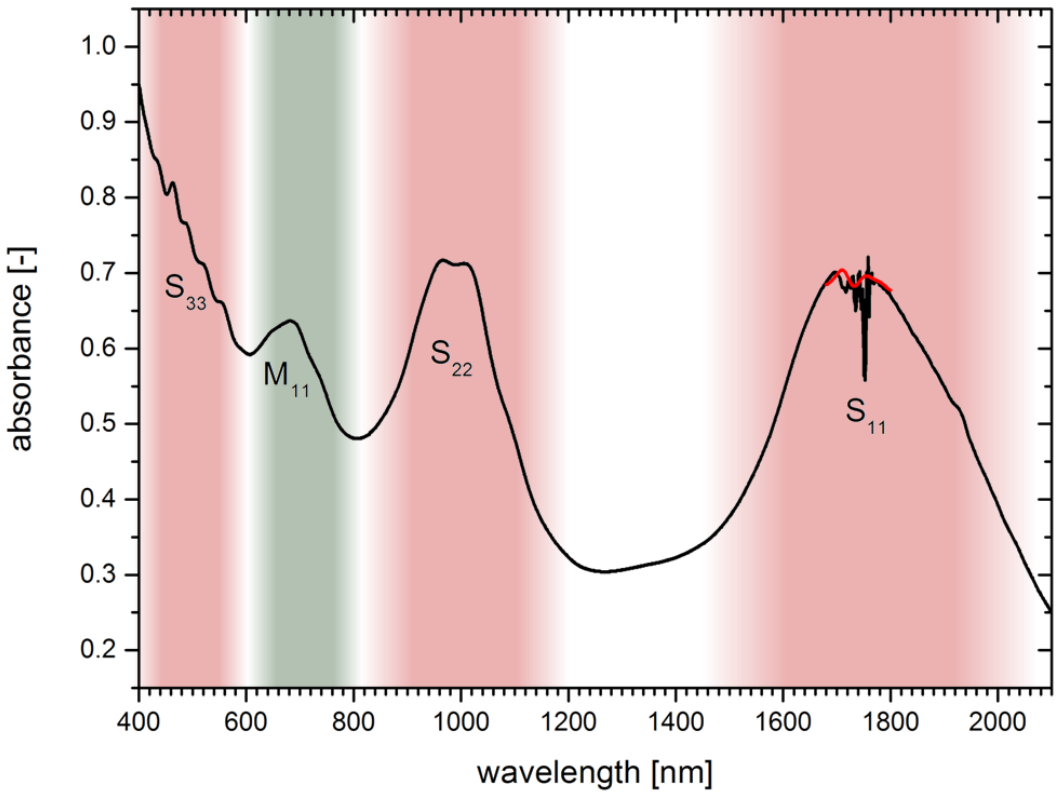

Figure S4 UV-Vis/NIR spectrum of an Iljin SWCNT dispersion in CHP. The different types of electronic excitation in semiconducting and metallic SWCNTs are indicated by the underlying colours.

III. UV-Vis/NIR spectra of an Iljin SWCNT dispersion before and after centrifugation

Fig. S 5 shows the absorption spectra of Iljin SWCNT dispersions with different initial concentrations. Assuming a quasi-constant extinction coefficient, the ratio of the absolute absorbance values allows an estimate of the mass loss. A comparison of the absorption at the most prominent peaks, that is, 464, 683, 965, and 1007 nm, results in an absorbance between 88 and 98% of the initial absorbance after the centrifugation step. Sun *et al.* showed that the absorption coefficients slightly differ prior and after centrifugation, leading to a slight underestimation of the mass loss.[1] Nevertheless, the mass loss is considered to account for by far less than 20%.

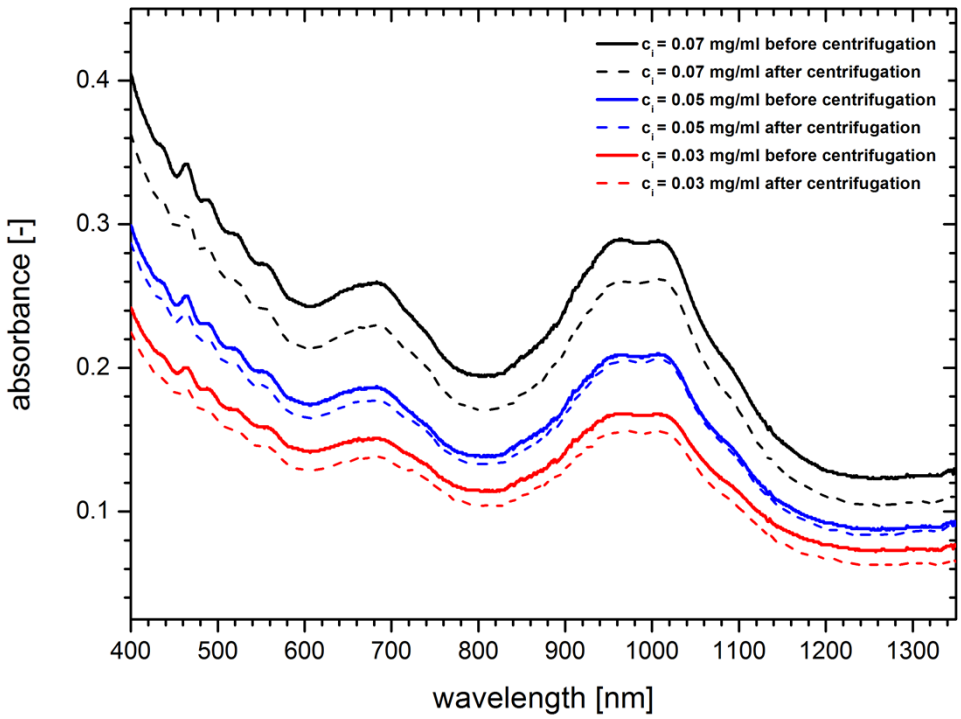

Figure S5 UV-Vis/NIR spectrum of Iljin SWCNT dispersions in CHP with different initial concentrations before and after centrifugation.

1. Z. Sun, V. Nicolosi, D. Rickard, S. D. Bergin, D. Aherne and J. N. Coleman, *J. Phys. Chem. C*, 2008, **112**, 10692-10699.