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Molecular Nanostructures

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freestanding sample at carriers densities above  $2.10^{11} \text{ cm}^{-2}$ . This proves that small amounts of doping smear out the asymmetry of the 2D-mode feature, which can be utilized as a hallmark of a quasi-neutral sample.

## MON 12

### Study of Substrate-Molecule Interaction in Functionalized Carbon Nanoribbons

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Carbon based hybrid nanostructures are an emerging field of current research. Within a theoretical approach combining density functional and density matrix theory, we found that photo-active molecules, considerably influence the optical properties of carbon nanotubes [1,2]. To obtain further insights on the nature of the molecule-substrate coupling, we extend these studies to functionalized 1-dim graphene nanoribbons and 2-dim graphene. Our theory predicts the splitting of the pristine transitions into multiple resonances exhibiting a considerable spectral shift. Both effects are strongly influenced by the electronic bandstructure of the substrate. This influence is studied for different subbands in the case of nanoribbons reflecting a large variety of bandstructure curvatures (from negative to positive and from linear to parabolic). Furthermore, we discuss the impact of dimensionality on the coupling by investigating ribbons of different widths, which reflect well the behavior towards the 2-dim graphene sheet [3].

[1] E. Malic et al. PRL 106, 097401 (2011)

[2] E. Malic et al. JPCM 24, 394006 (2012)

[3] G. Berghäuser and E. Malic, submitted (2013)

## MON 13

### The effect of the synthesis method on the morphology of indium-oxide/MWCNT composites

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Nowadays material science is of great importance the application of composite materials based on carbon nanotubes is widely investigated. Current work aimed at preparing nanocomposites of  $\text{In}_2\text{O}_3/\text{MWCNT}$  using an impregnation and a hydrothermal synthesis method. Indium (III) chloride ( $\text{InCl}_3$ ) was used as precursor material to cover the surface of carbon nanotubes, and distilled water and ethanol were used as solvents. In our samples the mass ratio was 4:1 ( $\text{In}_2\text{O}_3:\text{MWCNT}$ ), and different temperatures were examined during the calcination process: 300°C, 350°C and 400°C, respectively. The produced composite materials were characterized by X-ray diffraction (XRD), energy-dispersive X-ray spectroscopy (EDX), Raman microscopy, transmission electron microscopy (TEM) and scanning elec-

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## MON 14

### Bilayer Graphene Dehydrogenation

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## MON 15

### Size dependent properties of indium-oxide/MWCNT composites

Amelie Bier...  
Zeger Hens<sup>2</sup>

<sup>1</sup>Institute of...

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tron microscopy (SEM) techniques. From these results we could concluded that the composites manufactured with different methods resulted in various morphology. These new multiwalled carbon nanotube based composite materials are very promising candidates for testing as gas sensors or photocatalyst.

**MON 14****Bilayer Graphene Grown by Chemical Vapour Deposition (CVD) using Oxidative De-Hydrogenation Chemistry**

Laurent Bernard<sup>1</sup>, Jacim Jacimovic<sup>1</sup>, Massimo Spina<sup>1</sup>, Primoz R. Ribic<sup>1</sup>, Laszlo Forro<sup>1</sup>, Arnaud Magrez<sup>1</sup>

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Application of graphene is foreseen in composites, energy production and storage devices, touch screens and electronics. This conviction is the result of theoretical predictions of graphene properties, and relies on the outstanding performances of small sized prototypes fabricated with graphene exfoliated from graphite. Most predictions are yet to be verified experimentally while specifications of large-scale devices remain uncertified. To meet these objectives, extended films of high-quality graphene need to be produced reliably. CVD is the most suitable process yielding graphene from hydrocarbons over transition metal substrates. The most efficient synthesis proceeds from methane at elevated temperature and is not compatible with most applications. The use of oxidative dehydrogenation (ODH) is very promising for graphene growth by CVD as such chemistry has allowed the growth down to 300°C of carbon nanotubes with low defect density. We will report on the optimization of the reaction process shedding light onto graphene growth mechanism by ODH chemistry. The study of transport and optical properties of the resulting graphene will be presented as well.

**MON 15****Size dependent electron-phonon coupling in spherical CdSe nanocrystals**

Amelie Biermann<sup>1</sup>, Sofie Abe<sup>2</sup>, Raquel Gomes<sup>2</sup>, Karel Lambert<sup>2</sup>, Holger Lange<sup>1,3</sup>, Zeger Hens<sup>2</sup>, Christian Thomsen<sup>1</sup>

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Colloidal nanocrystals have attracted a lot of interest because they show fascinating properties such as two-photon absorption, multiple exciton generation and high photoluminescence. The possibility to synthesize defined nanocrystals with a precise control over their size, stoichiometry and crystal structure enables the use in systems like biological sensors, LEDs, lasers and solar cells.

The magnitude of the coupling of excited carriers to phonons within the material contributes to the time scales of different photophysical processes, of high significant