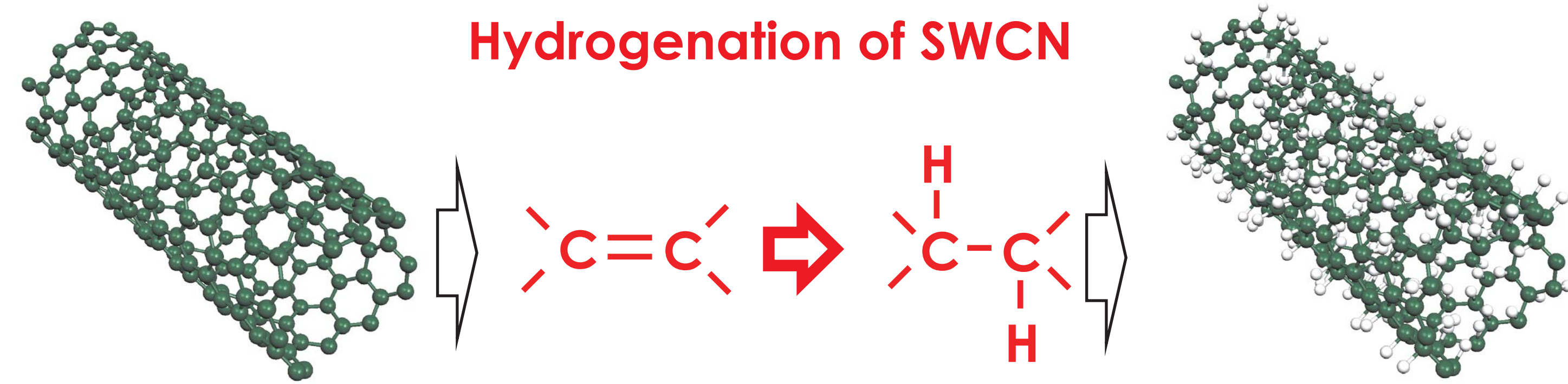


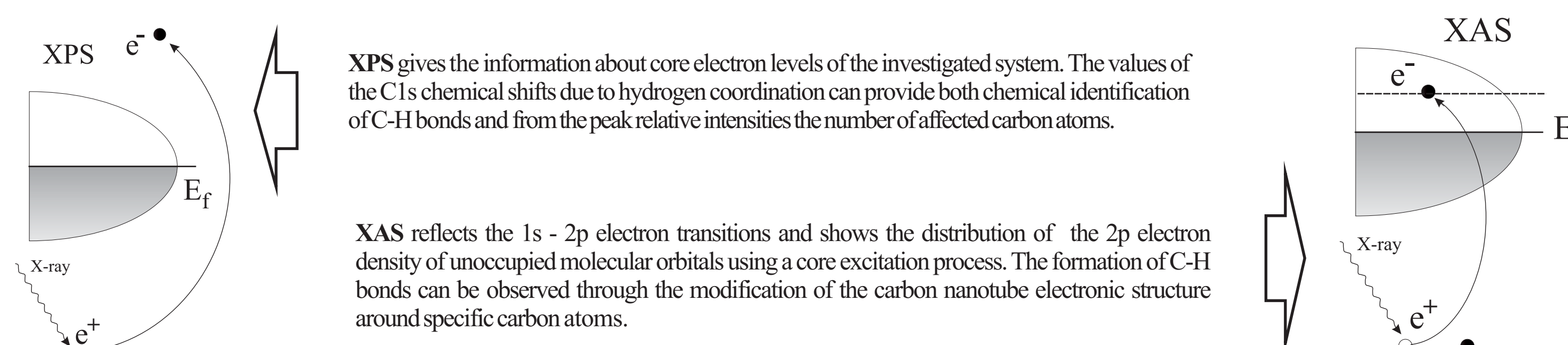
A. Nikitin<sup>1)</sup>, Z. Zhang<sup>2)</sup>, H. Ogasawara<sup>1)</sup>, D. Mann<sup>3)</sup>, X. Liu<sup>3)</sup>, H. Dai<sup>3)</sup>, KJ Cho<sup>2)</sup>, A. Nilsson<sup>1,4)</sup>

<sup>1)</sup> Stanford Synchrotron Radiation Laboratory, <sup>2)</sup> Department of Mechanical Engineering, Stanford University, <sup>3)</sup> Department of Chemistry, Stanford University, <sup>4)</sup> FISIUM, Stockholm University, Sweden

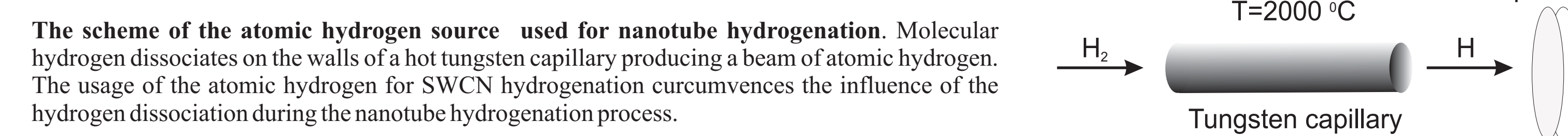
**Idea:** storing hydrogen in the chemisorbed form on the surface of the carbon nanotubes



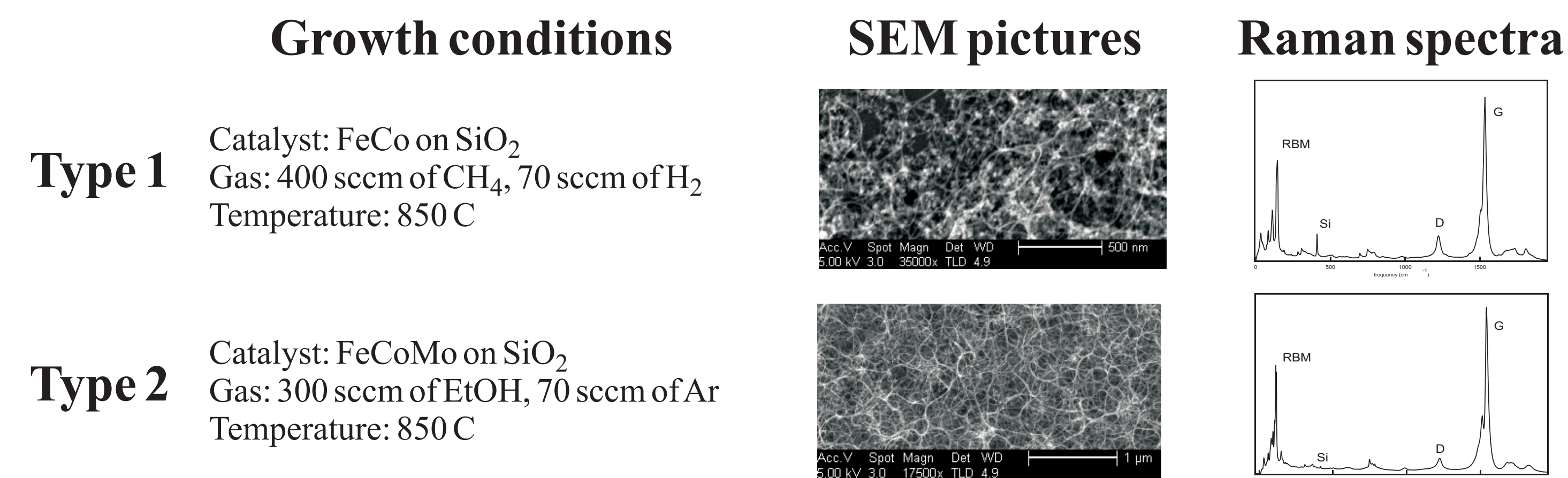
**Probing tools: X-ray Photoelectron Spectroscopy (XPS) and X-ray Absorption Spectroscopy (XAS)**



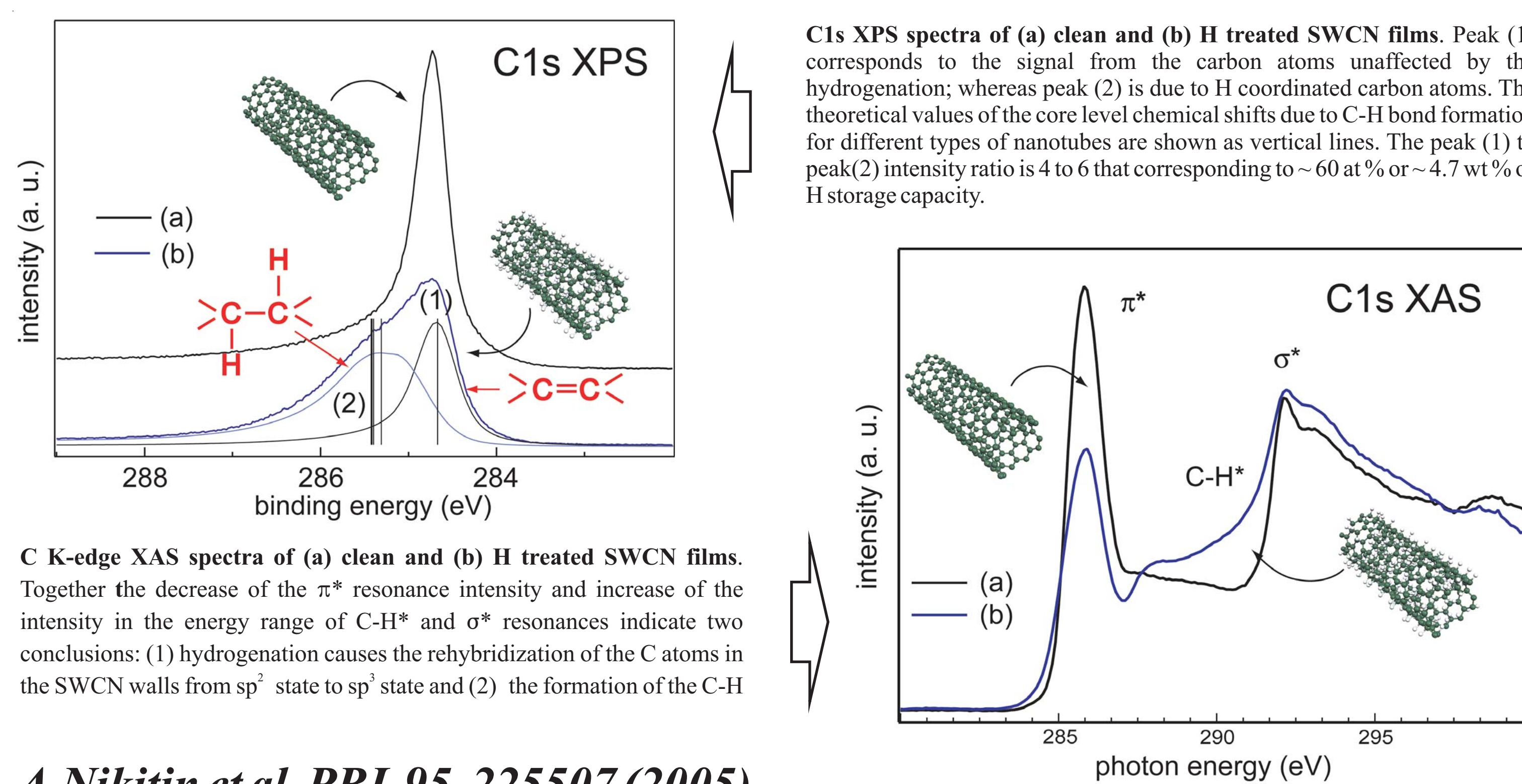
**Hydrogenation: in situ atomic hydrogen treatment**



**Samples: ultra clean "as grown" SWCN films**

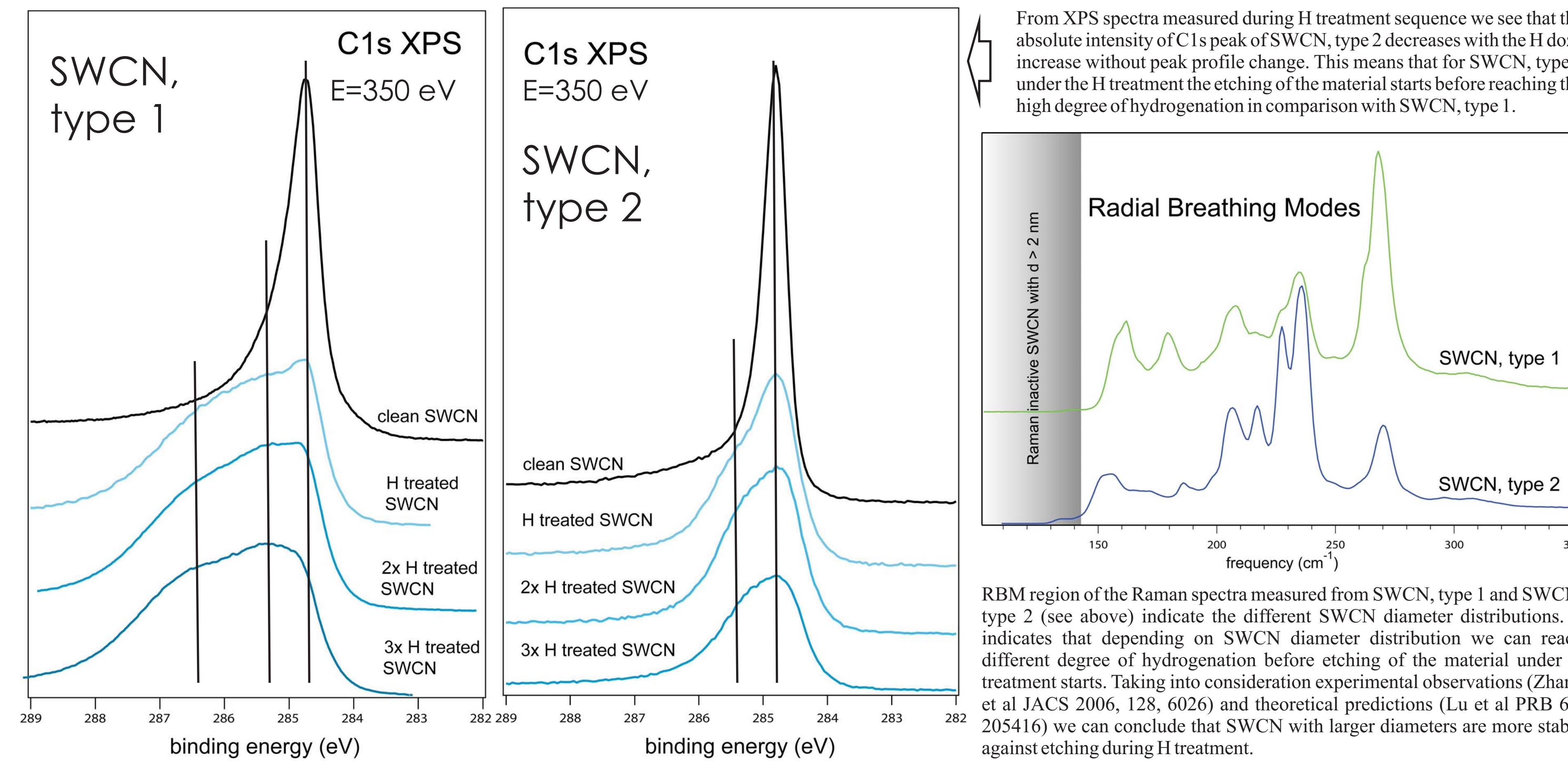


**XPS and XAS spectra of the clean and hydrogenated SWCN**

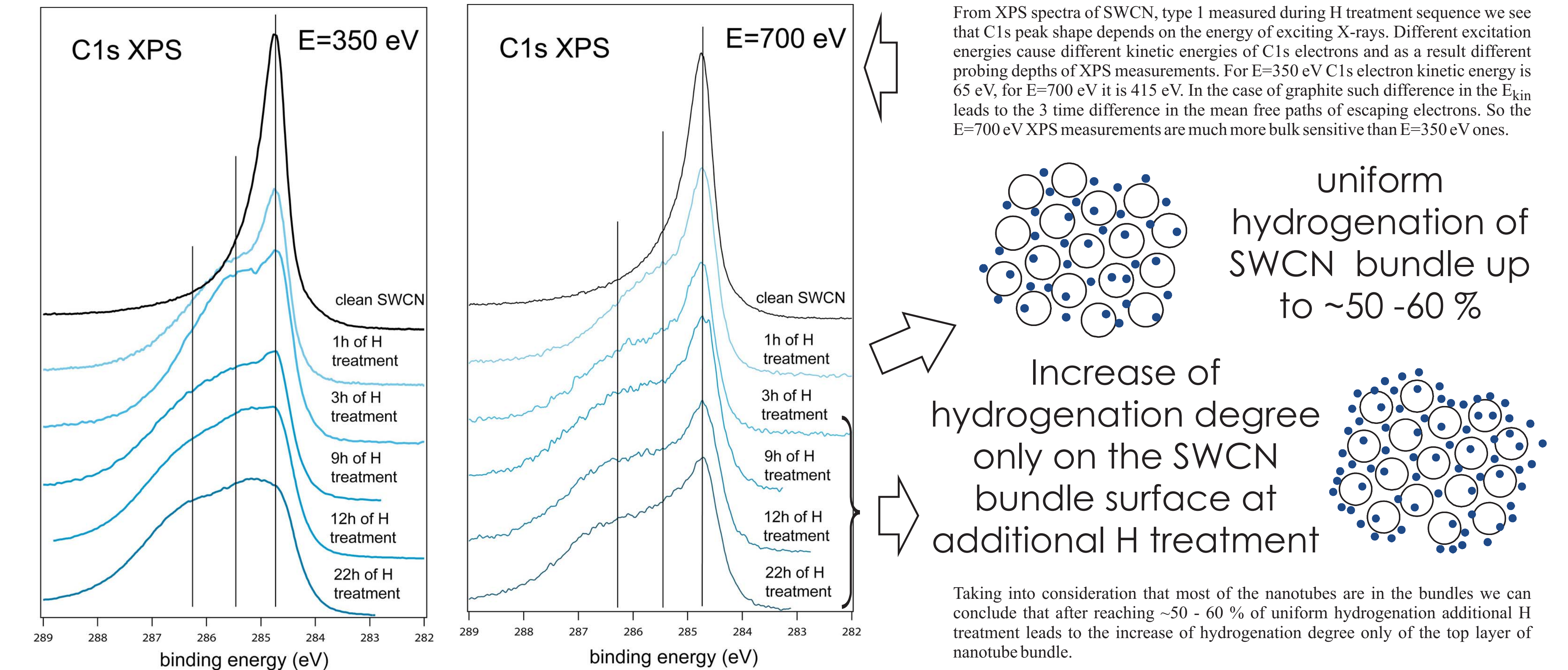


A. Nikitin et al, PRL 95, 225507 (2005)

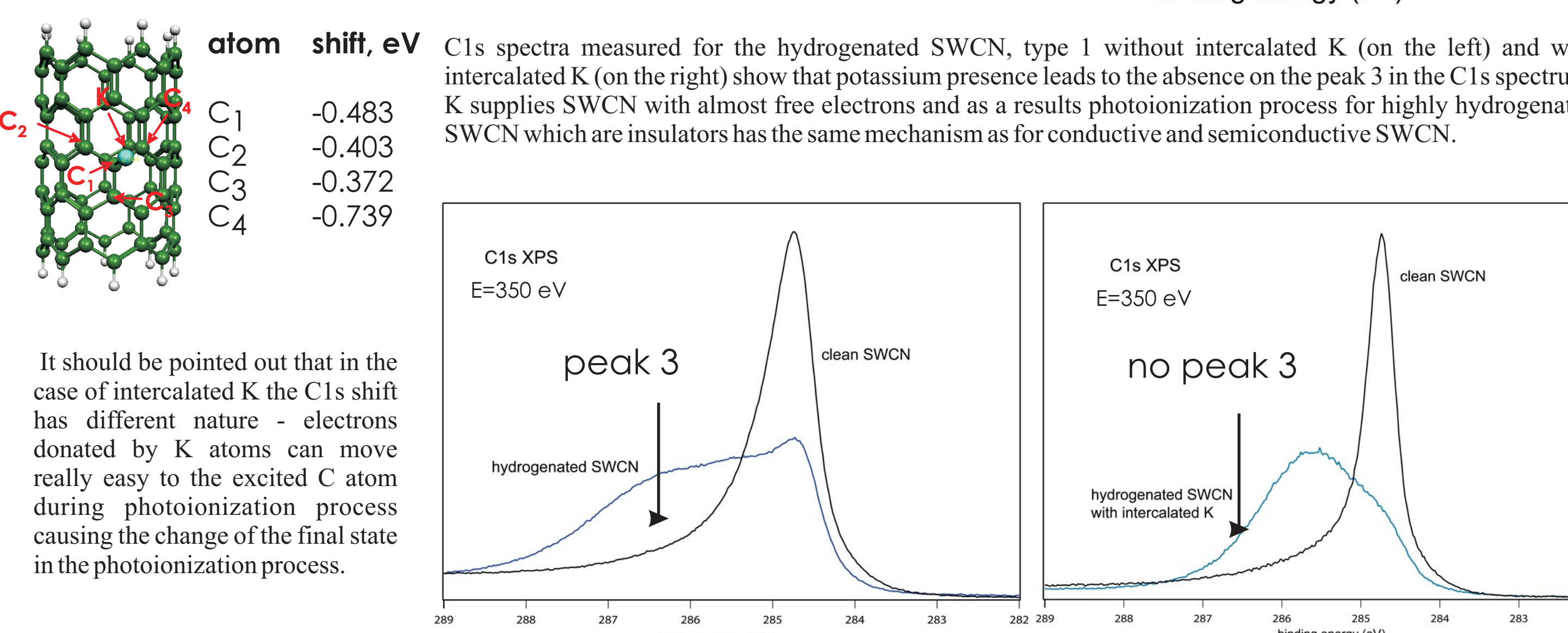
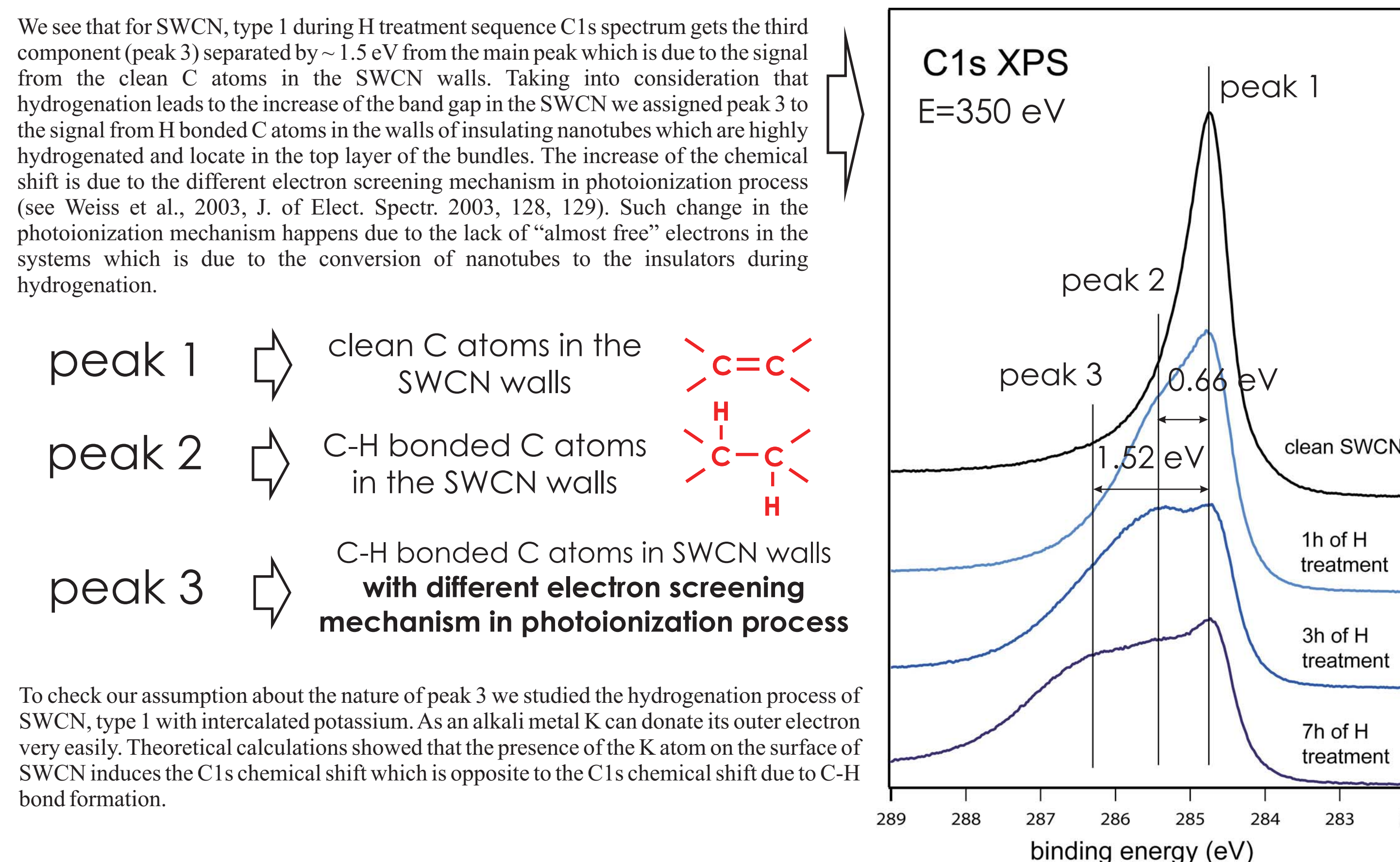
**The influence of SWCN diameter distribution on hydrogenation process**



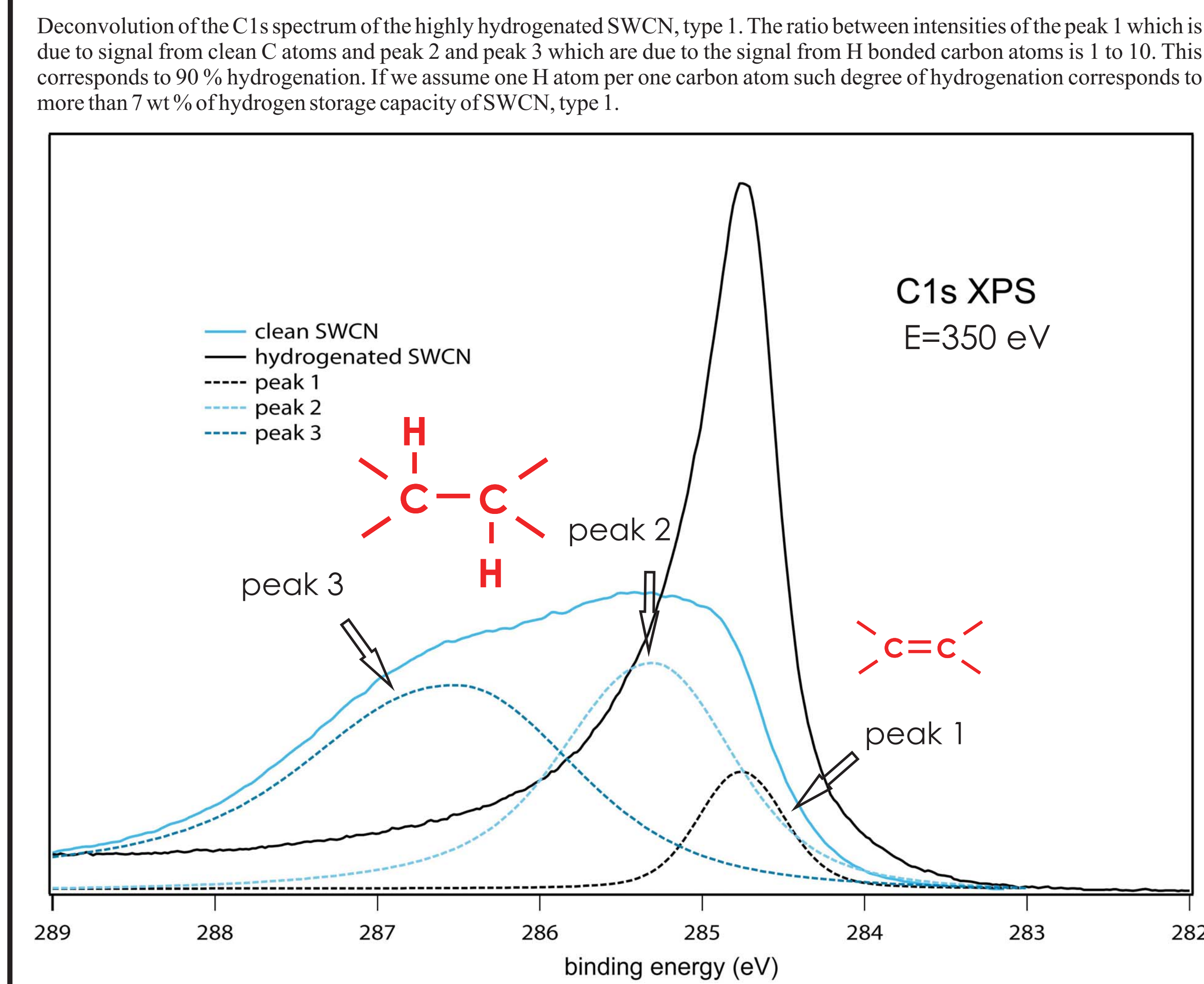
**The influence of SWCN bundling on hydrogenation process**



**The dependence of C1s peak shape on the SWCN hydrogenation degree**

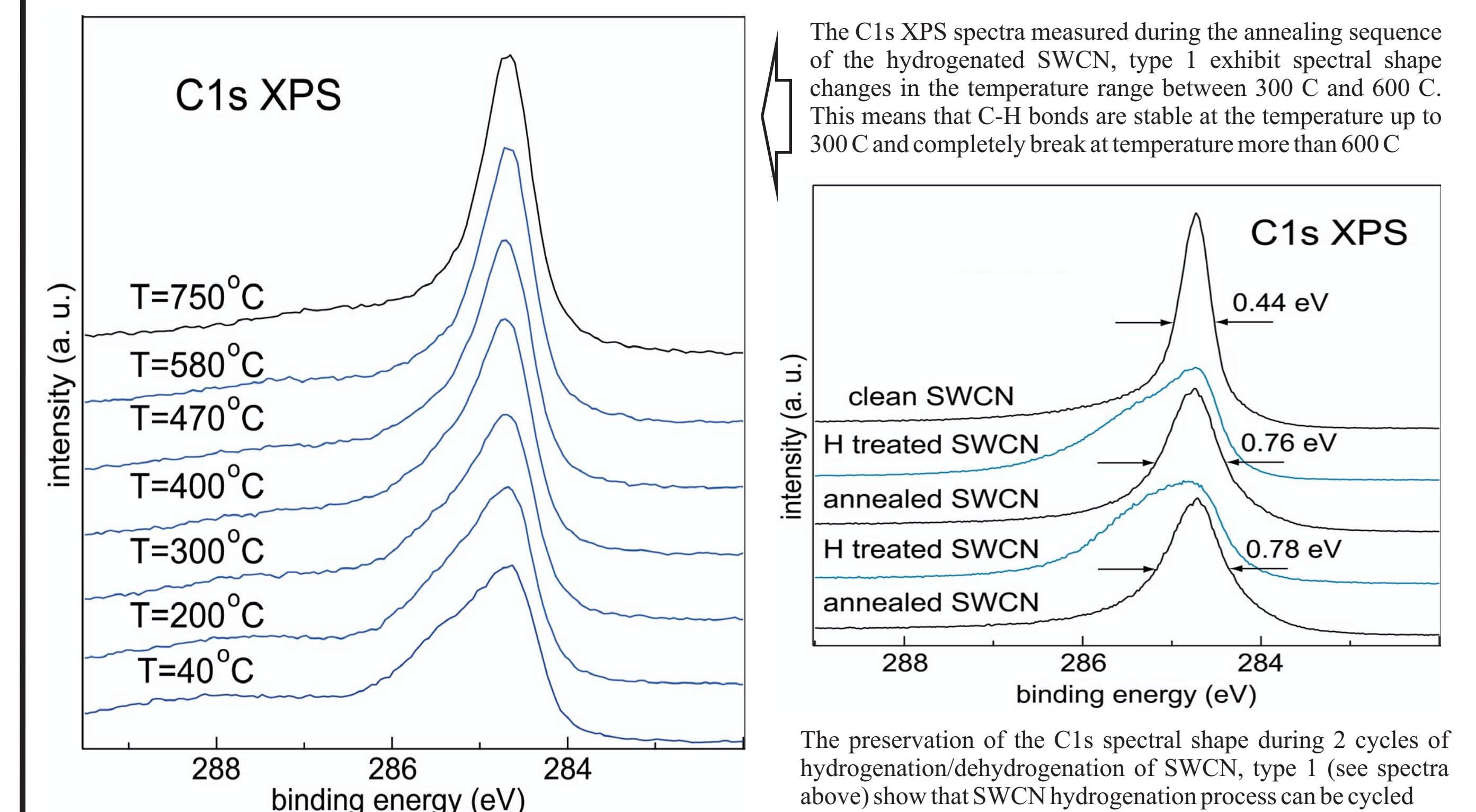


**The maximal hydrogenation degree of SWCN**



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**The stability of C-H bonds in hydrogenated SWCN and hydrogenation cycling**



**Conclusions**

1. SWCN with different diameters can reach different hydrogenation degree before "unzipping" and etching
2. For specific SWCN it is possible to hydrogenate almost 100 at% of the carbon atoms in the walls to form C-H bonds which corresponds to > 7 wt% of SWCN hydrogen capacity
3. The hydrogenated SWNT are stable from ambient temperature to 300 C
4. Hydrogenation/dehydrogenation process can be cycled.