# Growth of Mn-catalysed GaAs Nanowires by Molecular Beam Epitaxy.

F. Jabeen*, G. Bais, M. Piccin, S. Rubini, F. Martelli, and A. Franciosi

*Laboratorio Nazionale TASC INFM –CNR S. S. 14, km 163.5, 34012 Trieste, Italy and*
*Centro de excellenza per i Materiali nanostrutturati, Universita` de Trieste , 34127 Trieste, Italy*

Semiconductor nanowires (NWs) attract great interest for their potential applications in electronics and optoelectronics, as well as for the physics underlying their growth mechanism. NWs are obtained by several growth techniques, generally assisted by a metal catalyst particle.

We report here the growth of GaAs NWs by molecular beam epitaxy (MBE) assisted by Mn catalyst. The main reason to use Mn is to exploit the possible catalyst diffusion to obtain GaAs:Mn NWs.

Our aim is to investigate by scanning electron microscopy (SEM) density and morphology of the NWs as obtained on different substrates, in particular $SiO_2$, and GaAs, the latter with different surface orientations. Growth on GaAs has been performed on both oxidized and epitaxial surfaces. The substrate-Mn interaction has been studied by *in situ* x-ray photoelectron spectroscopy (XPS).

The NWs were grown in a ultra-high-vacuum facility including a III-As solid source MBE chamber, a metallization chamber for Mn deposition and an XPS analysis chamber. 1 nm Mn was deposited on the substrates at room temperature. The substrates were then introduced in the MBE chamber and GaAs growth was performed for 30' at substrate temperatures ($T_g$) in the 500–650 °C range with growth conditions corresponding to a 2D growth rate of 1 μm/h. Epitaxial surfaces were grown just before Mn deposition.

Several μ-long NWs, with lateral dimension between tens and 200 nm are obtained on $SiO_2$ for $T_g$ between 540 and 620 °C. Together with the NWs, quasi-2D structures, a kind of nanoleaves, are also obtained, see Fig(b) inset ($T_g$ =540 °C). On oxidized GaAs (100) substrates we observe the coexistence of NWs and nanoleaves, see Fig. (a) ($T_g$ =540 °C). The fraction of leaves increases for raising $T_g$, dominating above 560 °C. Both kinds of nanostructures appear

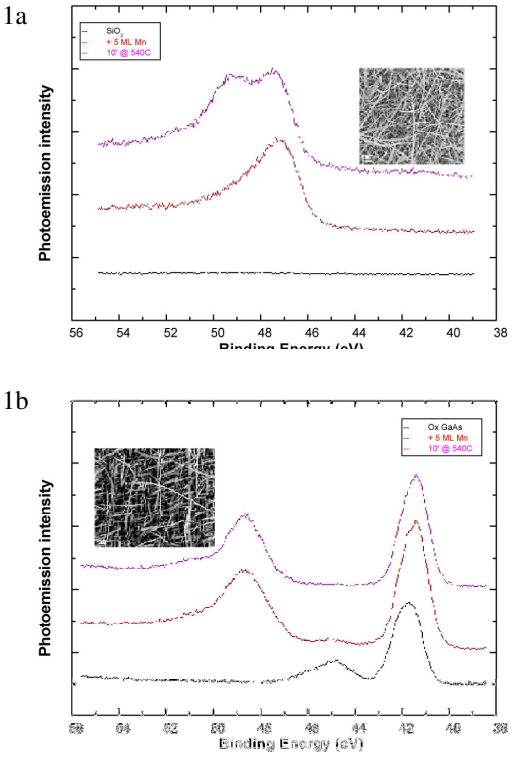


Fig. (1a, 1b) show photoemission intensity recorded in the binding energy region corresponding to Mn 3p and As 3d core-level emission, as obtained on the clean substrates (bottom traces), after deposition of 1 nm of Mn (middle traces) and after heating at 540 °C (top traces) for, $SiO_2$ (1a) and ox-GaAs (1b).

*Email. jabeen@tasc.infm.it