PLASMA DEPOSITION OF AMORPHOUS SILICON ALLOYS FROM FLUORINATED GASES

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In the last two decades, plasma deposition processes of hydrogenated amorphous silicon and its alloys have been investigated and many applications have been developed (solar cells, photoreceptors and thin film transistors) and others are going to be exploited (memories, bipolar transistors). However, the development of a completely integrated a-Si:H technology is strictly related to the definitive "design" of the silicon-based alloys, such as SiGe, SiC and SiN. These materials have optical and electrical properties continuously adjustable in a wide range, according to the kind and amount of the alloyed atom, since stoichiometry is not required.

Nevertheless, the worsening of the photoelectronic properties of SiGe and SiC with increasing the alloyed partner and the uncomplete chemical stability of SiN material are still existing problems. Recently, these inconveniences are reserving considerable efforts and significant improvements have been obtained when silicon-based alloys are deposited in new deposition systems, under H_2-dilution and/or from fluorinated precursors.

In this lecture we report on the plasma deposition of amorphous silicon films and its alloys (SiGe, SiC, SiN) starting from SiF_4 as Si-source alternative to silane and from GeH_4, CH_4 and N_2 as sources of alloying atoms.
Emphasis is given to:
-the plasma and surface chemistry during deposition of a-SiHF and its alloys.
-the role of fluorine in the gas and surface reactions and its threshold value as chemical constituent of the material, before observing degradation.