ESRF	**Experiment title:** EXAFS investigation of erbium ion implanted in Si for optoelectronics applications.	**Experiment number:** HS-233
Beamline: BM08	**Date of experiment:** from: 02/ll/97 to: 02/18/97	**Date of report:** 04/01/97
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Names and affiliations of applicants (* indicates experimentalists):

A. Terrasi *, G. Franzo *, S. Coffa*
IMETEM - Consiglio Nazionale delle Ricerche

F. Priolo *
INFM and Dipartimento di Fisica
Universita di Catania

Report:

The possibility to achieve carrier-mediated luminescence at 1.54 μm from Er-doped crystalline Si has motivated several investigations on the properties of the Er-Si system . It is now understood that the efficiency of this process is critically dependent on the lattice position of the Er ions in Si and on the chemical environment around them. In particular, several studies have shown that proper co-doping with impurities, such as 0 or F, produces dramatic modifications in the chemical environment site structure and electrical properties of the Er ions.

The beam time awarded to the experiment HS-233 has been used for EXAFS measurements on several samples prepared by ion implantation of Er and 0 (or Er and F) in (100) Si wafers. Because of the short time elapsed from the experiment to the present report, we cannot produce at the moment any quantitative result obtained from the analysis of the collected data which are, nevertheless, very promising. However, these

measurements follow those performed at ESRF during an Italian user dedicated beam time in 1996. The results of the former experiment are now in press on the March 31st 1997 issue of Appl. Phys. Lett. The abstract of this paper and a representative figure are attached below.

Abstract

We present Extended X-ray Absorption Fine Structure (EXAFS) analyses of the Er L,,, edge in Er-doped (100) Si samples. The samples were prepared by multiple implants of Er and 0 resulting in the incorporation of 1 x 1 0^{19} Er/cm^3 and 1 x 10^{20} O/cm^3 in a 2.3 pm thick amorphous layer. It has been found that the local environment around the Er sites, which consists of 6 Si first neighbors in the amorphous layer, evolves towards a mixed coordination with 0 and Si atoms after epitaxial regrowth of the layer at 620 °C for 3 hrs. This indicates that a significant Er-0 interaction has already occurred during this process. A further thermal treatment at 900 °C removes the residual Er-Si coordination and produces a full oxygen coordinated first shell with an average of 5 0 neighbors. Quantitative analysis also suggests that Er sites with a different oxygen coordination number and/or different medium range order are present in the samples.

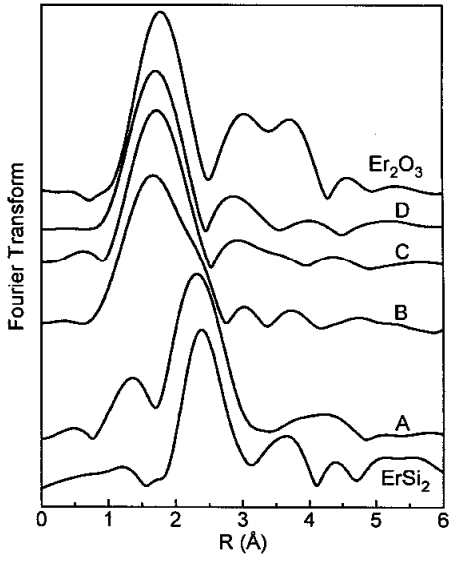

Fig. 1 - Fourier Transform of the EXAFS functions χ(k) multiplied by k^2. Capital letters indicate the thermal processes: 450 °C 30 min (A), A+ 620 °C 180 min (B), B + 900 °C 30 s (C), B + 900 °C 30 min (D). Note the evolution of the Er sites from a Si-rich to an O-rich environment.