10-1 *INVITED*: ION IMPLANTATION INTO MOS STRUCTURES

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Ion implantation effects in MOS structures can be divided into four groups:

1) Radiation effects a. in SiO_2
   b. in Si

2) Doping effects a. in SiO_2
   b. in Si

Doping effects are of general interest but before they can be studied radiation damage has to be removed by annealing. Implantation damage results in defects in the oxide, the interface and the silicon. All these defects cause different interface states which are distinguishable. The oxide and interface can be annealed at 500 °C while damage in Si needs higher temperatures.

The oxide can be doped by implantation with alkali ions resulting in positive charge of varying degrees of mobility. Cs can be used to create stable positive charges.

Ion implantation can be utilized to produce artificial surface states by implanting certain elements into the interface. Every element causes characteristic energy levels which are more or less discrete and in most cases identical with those in bulk silicon. By increasing annealing temperature in steps transient energy levels can be observed. A large number of elements have been studied and their energy levels determined. Some of them appear to be useful for controlling lifetime of minority carriers. Of particular significance is Be which being a light atom lends itself particularly well to implantation. It is more effective then Au in reducing lifetime. Because of its low solubility in Si it has a tendency towards outdiffusion at elevated temperature. Ge acts in a comparable way. The effective levels of Ge are thermally unstable and disappear above 500 °C.