QUARTERLY REPORT

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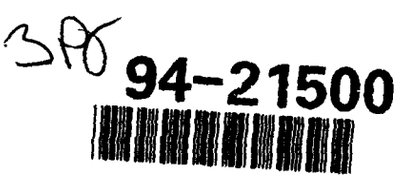

OFFICE OF NAVAL RESEARCH PROGRESS REPORT

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During the last quarter one of our students (T.C. Lin) has satisfied the requirements for his Ph.D. degree. This was possible due to the support we have received on this contract. A copy of his thesis can be supplied to anyone with a serious interest. We are in the process of writing a paper to be submitted for publication covering the most recent results of his work. He has published two papers previously describing earlier results from this contract.

In our previous report we discussed Lin's results on the effect of Germanium Implantation on hot carrier injection. We have repeated this work numerous times and have always obtained the same result: that this process does indeed result in a large reduction in the hot carrier injection. Our previous report also mentions the undesirable result that this implantation does increase the electron trapping in the SiO_2. This could be eliminated if the implantation is done before the oxidation but the hot carrier reduction was reduced in this case. We explained these results as being due to the localization of the Germanium at the Si-SiO_2 interface. Subsequent measurements have demonstrated that this is the case since there was a much larger increase in the interface trap density if the implant was done before the oxidation.

It has been suggested the oxide traps due to Germanium result from the partial oxidation of the implanted Germanium. If this is the case then we might expect that the electron trapping could be significantly reduced if the sample is given a very short exposure to a oxygen ambient after the implant. The exposure times would be of the order of a few minutes and would not be sufficiently long to make it possible for the implanted Germanium to migrate to the interface. Thus, we would reduce the electron trapping but still have the large reduction in the hot carrier injection. We are in the process of doing these experiments at the present time. Hopefully, the results will be available for our next quarterly report.

We have also verified the results reported by Ng et al. earlier that the Germanium does not have a measurable effect on the MOSFET device characteristics. This also indicates that Germanium only scatters the hot carriers and not the carriers that carry the current in the device, an important finding for devices. This poses a very interesting challenge to the theoreticians to see if this can be explained. One simple model might be that the Germanium effectively eliminates the longer electron paths which are required to obtain the larger energies from the applied field. Another possible explanation might be that there is a selective scattering process that is more effective for the energetic portions of the electron energy density spectrum.

We have measured our implanted devices at 77K and have observed an even larger reduction in the injected current at this temperature. For comparison we have also implanted

some devices with Carbon instead of Germanium but found no reduction in the injected current.

Another doctoral student (Materials Science and Engineering) on this project, , S.J. Kilpatrick, passed his dissertation research proposal exam on the topic "The Low Temperature Oxidation Behavior of SiGe Thin Films in a Fluorinated Ambient." He has made steady progress on his academic requirements which will culminate in his oral general exam in July.