Abstract Submitted
for the 4CF14 Meeting of
The American Physical Society

Detection of Percolation in Hermetic Single-Device Human Implants by Ion Beam Analysis (IBA)[1] NICOLE HERBOTS, Arizona State University, Physics Dpt, SiO2 NanoTech, M.W. MANGUS, ASU Physics, LE-CSSS, M. NERIC, A.J. WOOLSON, R.J. CULBERTSON, ASU Physics, B.J. WILKENS, ASU LE-CSSS, A.W. CAUSEY, A.L. BRIMHALL, ASU Physics, C.F. WATSON, SiO2 NanoTech LLC, S.A. SINHA, A.J. ACHARYA, ASU Chemistry & Bio-Chemistry — Percolation of bodily fluids into medical implants limits device lifetimes to less than a week in permanent glucose sensors for diabetics. Rutherford Backscattering Spectrometry (RBS) can detect C, O, Na from these fluids. But the RBS detection limit, $\mathbf{D^{min}}$, is inadequate for low Z elements in higher Z substrates. With 2 MeV $^4He^{2+}$, $\mathbf{D^{min}}$ of C in Si is $\sim$ 5 ML. The 4.265 $\pm$ 0.05 MeV $^{12}C(\alpha,\alpha)^{12}C$ Nuclear Resonance Analysis (NRA) reduces $\mathbf{D_{Si}^{min,\,C}}$ to $\sim$ 0.05 ML. Next, NRA combined with channeling can lower $\mathbf{D_{min}}$ by 20-50, with $\mathbf{D_{Si}^{min,\,C}}$ <0.002 ML for C. Thirdly, geometry, such as the tilt angle of the <111>axis with the Si(100) surface almost doubles the sampled depth, reducing $\mathbf{D_{Si}^{min,\,C}}$ by 1.7. Low $\mathbf{D^{min,Na}}$ is needed as mobile Na ions destroys electronic sensors. In this work, $\mathbf{D^{min,Na}}$ is increased using $^4He^{2+}$ near 4.68 MeV, by a factor 1.44. C, O and Na from blood and saline are studied.

[1]We gratefully acknowledge the use of facilities with the LeRoy Eyring Center for Solid State Science at Arizona State University.

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Date submitted: 13 Sep 2014 Electronic form version 1.4