

Mechanical Properties of Parylene C Thin Films: a Flexible Packaging/Coating for Active Biomedical Implants

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There is a growing need for flexible, hermetic, conformal biocompatible packaging for active biomedical implantable devices and probes. In use, the packaging will be under continual attack from corrosive biological fluids as well as mechanical loading from both motion-induced stresses and residual stresses resulting from thermal expansion mismatches within the biomedical devices. In addition, for some applications, the coatings will be exposed to local electric fields. Poly (monochloro-p-xylylene), trade name Parylene C^a, is being explored as a potential coating because it is reported to be flexible, chemically inert, electrically insulating, with low water and ion permeability. Since it is deposited using chemical vapor deposition, Parylene C can provide a uniform, conformal coating on almost all surfaces and geometrical shape. Currently, there is no generally accepted standardized test method for evaluating reliability or lifetimes of such coatings/packaging material. Previous work investigating mechanical properties of Parylene C have typically used large area loading tests resulting in average yield^b and deflection^c values. In this paper, we present preliminary mechanical property from free-standing, 18 microns thick Parylene C films using nanoindentation measurements to evaluate elastic and plastic deformation distributions on a local scale.

^aFull description of the procedures used in this paper requires the identification of certain commercial products and their suppliers. The inclusion of such information should in no way be construed as indicating that such products or suppliers are endorsed by NIST or are recommended by NIST or that they are necessarily the best materials, instruments, software or suppliers for the purposes described.

^bShi, V. C-Y, Harder, T. A., and Tai, Y-C, Design, Test, Integration and Packaging of MEMS/MOEMS, Proceedings of DTIP 2003 394-398 (2003).

^cHarder, H.A., Yao, T-J, He, Q., Shih, C-Y, and Tai, Y-C, Proceedings of the 15th IEEE International Conference on Micro electro Mechanical Systems (MEMS '02) 435-438 (2002).