Fast deposition of plasma polymer layers

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199th ACS National Meeting

**Boston, Massachusetts
April 22-27, 1990**

**J. F. Kinstle, Chairman
G. R. Pilcher, Secretary**

MONDAY MORNING - SECTION A - SYMPOSIUM ON PLASMA POLYMERIZATION AND PLASMA INTERACTIONS WITH POLYMERIC MATERIALS (CONTINUED) - D.C. Schram and N. Inagaki, Presiding

1. THE FOURTH (PLASMA) STATE OF MATTER - A MATERIALS TECHNOLOGY FOR THE FUTURE. D.T. Clark, ICI plc, Wilton Materials Research Centre, P.O. Box 90, Wilton, Middlesbrough, Cleveland, England TS6 8JE.

Recent developments in the science of "cool" plasmas suggest that process technology based on non-equilibrium phenomena may become of considerable importance in the near future, indeed several significant steps taking scientific curiosity towards commercial process are already emerging. The realisation that many industrial processes could be faster, cheaper and produce less pollution if accomplished in the plasma state, has led to increasing interest in both academic and industrial research laboratories, into plasma chemistry whilst a number of industrial processes of significant scale have started to emerge. The potential for controlled synthesis and modification of ultra thin films by plasma, and related techniques involving ion and electron beams offers new opportunities for the cost effective engineering of special effects (chemical, physical, electrical, mechanical, etc.) and the talk will outline some of the challenges to be faced in this exciting field for the future which fits into a generic theme of spatial control of processes to materials which also encompasses the high rate, high temperature processes involving the plasma state generated by directed high energy sources such as lasers.

2. FAST DEPOSITION OF PLASMA POLYMER LAYERS. J.J. Beulens, G.M.W. Kroesen, D.C. Schram, and C.J. Timmermans, Department of Physics, Eindhoven University of Technology, 5600 MB Eindhoven, The Netherlands, P.C.N. Crouzen, H.J.A. Schuurmans, J. Werner and C. Beyer, Shell Laboratories, 1003 AA Amsterdam, The Netherlands.

In a combined effort of the Eindhoven University of Technology and Shell Laboratories Amsterdam, the potential of a new plasma deposition method for polymer deposition has been investigated. In this method a high pressure plasma arc is expanded into a vacuum chamber. The monomer is injected either in the arc or in the vacuum chamber. Two modes exist: at pressures around 1 mbar a directed beam is formed leading to high deposition rates at areas of 100 cm². At lower pressures, the plasma is evenly distributed and lower rates for larger areas are the result. Several characteristics of the deposition (as rate, etc.) have been measured. Special attention has been devoted to the relation between power load on the substrate and the useful particle load. The effect of substrate temperature on the deposition has also been studied. The thickness is determined by He-Ne ellipsometry, and characteristics of the layers by IR and visible ellipsometry.

3. PLASMA POLYMERIZATION WITH A LOW PRESSURE CASCADE ARC PLASMA SOURCE. S. Fuszman and H.K. Yasuda, Dept. of Chemical Engineering, University of Missouri-Columbia, Columbia, Missouri 65211

In the present work, a cascade arc operating at low pressures in either a glow or an arc discharge mode was used to deposit plasma polymer films from TFE or methane,