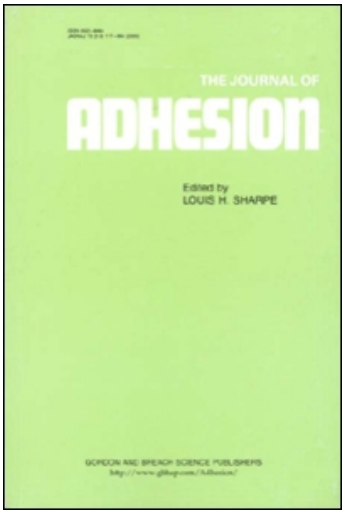

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A Word from the Editor

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A Word from the Editor

It is our great pleasure to congratulate Professor Manoj Chaudhury on his receipt of *The Adhesion Society Award for Excellence in Adhesion Science, Sponsored by 3M*, given during the Society's Annual Meeting held in Mobile, Alabama, USA, 13–16 February 2005. It is also with pleasure that we present, in this issue, Part 1 of a Collection of papers honoring him on his receipt of the Award.

Below we have reprinted, with the kind permission of The Adhesion Society, some details regarding the Award and a brief statement of the accomplishments on which the presentation of the Award to Professor Chaudhury is based.

There also follows an appreciation of Professor Chaudhury by a former colleague at Dow Corning and a friend, Dr. Michael J. Owen entitled "Manoj Chaudhury—The Industrial Aspect."

Louis H. Sharpe
Editor in Chief

THE ADHESION SOCIETY AWARD FOR EXCELLENCE IN ADHESION SCIENCE *SPONSORED BY 3M* 2005 AWARDEE: PROFESSOR MANOJ CHAUDHURY

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"For exceptional creativity and ingenuity in research on adhesion and wetting and the development of simple methods to measure the strength of attraction between materials"

Intermolecular attractive forces form the basis for adhesion. For many years, these forces were interrogated by contact angle measurements. More recently, methods based in contact mechanics have been used for those investigations. Prof. Chaudhury has played a significant role in both of these areas.

He has generated theories of van der Waals interactions and has examined contact angle methods to infer surface energetics. In

particular, his polar and apolar component of surface energy description generated a lot of interest and follow-up examination. Following his graduate work, he made technological contributions at Dow Corning Corporation. A number of issued patents describe methods of adhering and methods of improving adhesion. Breakthrough work was done during a sabbatical at Harvard University, when Prof. Chaudhury worked on surfaces with gradient surface tension and made water run uphill. More significantly, he began his work on contact mechanical measurements of adhesion at that time and did his seminal work on the surface energetics of silicone elastomers. That work forms the basis for many experiments and, in fact, the contact mechanical measurement of the surface energy of silicone is still the "acid test" for the technique. He also brought self-assembling monolayers to bear as a method of interrogating adhesion phenomena. After joining the faculty at Lehigh University, Prof. Chaudhury expanded this technique into new useful areas including the rolling contact mechanics test. He has endeavored to make his work relevant by extensions of his research into the surface energetics and mechanics of release of pressure sensitive adhesives and into the durability of aerospace structural adhesive bonds. In addition, he has played a role in promoting the science of adhesion by his active participation in our Society as well as promoting the science in other venues.

His prolific work has resulted in numerous refereed publications, issued patents, well-attended presentations and an active research group at Lehigh University. Prof. Chaudhury has been most influential in steering the adhesion science community into thinking about and testing adhesion phenomena in new and unique ways. In recognition of these important contributions to adhesion science, the 2005 Adhesion Society Award for Excellence in Adhesion Science, sponsored by 3M, will be given to Prof. Manoj K. Chaudhury. He will receive his award at the 28th Annual Meeting of the Adhesion Society. A symposium will be held in his honor the Annual Meeting on Sunday, February 13, 2005.

For more information about this award, including the nomination procedure, please see The Adhesion Society's website at www.adhesionsociety.org/awards/award_ex.htm

MANOJ CHAUDHURY—THE INDUSTRIAL ASPECT

During his time as a Dow Corning Employee and later as the Dow Corning Professor at Lehigh University, Manoj has made seminal

contributions to silicone technology of great industrial importance. The occasion of his receipt of the *2005 Adhesion Society Award for Excellence in Adhesion Science, Sponsored by 3M*, is an opportunity to record some of these broad ranging contributions. We were lucky to get Manoj. In the mid 1980's when we were seeking a researcher with proven expertise in adhesion, or with high potential of achieving that favored state, we naturally included Lehigh University in our search. Manoj was engaged in post-doctoral work there but we failed to find him; indeed we failed to find anyone suitable at Lehigh or anywhere else for quite a while. Somehow we connected with a St. Louis head-hunter. After politely declining his first suggestion, himself, he offered us Manoj's resume and the search was over.

I would classify Manoj's contributions to the science and technology of silicone surfaces as falling into five broad classes:

- Release substrates
- Silane coupling agents
- Creation of novel surfaces
- Surface characterization
- High voltage insulation

I will confine myself to a small part of his relevant output; just two citations for each of these areas. Release coatings can be thought of as the pressure-sensitive adhesive delivery system. This is a commercially important industry with a global market size of the order of one billion US dollars. The conventional explanation for the efficacy of PDMS as a release coating is its low surface energy but as Manoj has shown it is rather more complicated than this, other factors such as interfacial dynamics and rheological considerations also play an important role. A notable example of unexpected behavior is the relatively poor release of PSAs from certain fluoropolymer surfaces that have lower surface energies than PDMS. The concept of interfacial slippage occurring during the release process has shed abundant new light on this behavior. The paper by Newby, Chaudhury and Brown [1] provides an excellent introduction to this concept, but see also the study of Gordon et al. [2] for an illustration of how these fundamental concepts can be applied to industrially important materials. The importance of mechanistic understanding in improving the performance of existing products and opening the way to new ones cannot be overestimated.

The silane coupling agent field is also a billion dollar market. Manoj has contributed to new materials (his name is on some very useful patents), new understanding and novel investigative techniques.

I cannot resist drawing the reader's attention to a paper by Chaudhury and Plueddemann on the bonding of gold to glass using organosilane primers [3]. That these two Excellence in Adhesion Science Awardees should have worked together in our Adhesion Expertise Center is a competitive advantage if ever I saw one! The other citation in this field that I should like to commend to you is the study by Gellman et al. [4] on a SNMS study of silane coupling agents at the metal/polymer interface. This and related papers using XPS clearly establish a role for the interpenetrating network hypothesis of silane coupling agent action. There is plenty of evidence in the literature on chemical bonding between various metal surfaces and coupling agents but surprisingly little on the interaction with the polymer phase. These papers are landmarks in our improved understanding of silanes at interfaces.

The centerpiece of Manoj's creation of novel surfaces is his application of self-assembled monolayers to plasma-activated silicone polymer surfaces. This methodology was perfected while Manoj was on sabbatical leave from Dow Corning Corporation at George Whitesides laboratories at Harvard. We all know how valuable his use of the JKR technique proved to be but it needed the versatility of these novel surfaces to make it possible. This is also the point in this appreciation to acknowledge the role of enlightened R&D management in providing such fellowships as Manoj enjoyed at Harvard and subsequently establishing the Dow Corning Professorship at Lehigh University for him. We thank Dr. F. W. Gordon Fearon for his pivotal role in these activities. The novel surfaces I recall most fondly are the gradient surfaces. It was here that we first learnt of Manoj's talent for eye-catching titles. "How to Make water Run Uphill" [5] attracted world-wide media attention on a scale not often seen in our laboratory. The other novel surface I should like to highlight is the one provided by Thanawala and Chaudhury [6]. They modified the surface properties of a PDMS elastomer by reacting a perfluoroether additive into the composition. This approach offers a new generation of fluorosilicone surfaces with both backbone and side-chain flexibility that opens the door to very novel release substrates.

Manoj's use of the JKR technique to characterize silicone surfaces is an acknowledged masterpiece. I should like to draw attention to a novel adaptation of this technique to measure the energy of practical adhesion of silicone thin films by Chaudhury and Parbhoo [7]. This paper combines plasma treatment and the JKR approach in a typically clever yet simple way that is a hallmark of Manoj's style of research. The work is an example of international cooperation within the Dow Corning scientific community and led to important patents in the

electronics area as well as this elegant paper. Another interesting characterization paper is that of Kennan and colleagues [8] that extensively explored contact angle behavior on saline-treated medical grade silicone elastomers. This study was part of an effort during challenging times to refute some questionable literature claims regarding silicone breast implants.

The final area of comment is one that may be unfamiliar to many adhesion scientists. The similarity between plasma and corona treatment and their use in adhesion enhancement is well-known. However, there is an industrially important application where corona treatment is to be avoided and its effects mitigated as rapidly as possible. This is the use of silicones and other polymers as high voltage insulation materials. Joint studies between Manoj's group at Lehigh and Dow Corning in recent years [9, 10] have led to a much improved understanding of the value of silicone materials in this significant and growing market. The role of low molecular weight material in the hydrophobic recovery of corona-treated silicones has been elucidated. Importantly, the *in-situ* production of such species above a threshold discharge energy has been shown to be significant.

I am biased on this subject. I have been a colleague of Manoj since he joined Dow Corning Corporation and have enjoyed watching his influence in the adhesion community grow over the years. My partnership with him is my qualification for writing this appreciation and I trust readers will forgive the arrogance of citing papers here that bear my name along with Manoj's as industrial research these days is a team activity. Manoj is a great team player but more importantly he has vision and skills that set him apart as a worthy recipient of the 2005 Adhesion Society award for Excellence in Adhesion Science.

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