青山学院大学 物理・数理学科 コロキウム

２０１３年度 第５回

下記の通りコロキウムを企画致しました。学生や分野の違う方にもわかるレベルから始めて下さるようにお願いしてあります。

是非ともご参加下さいますよう、ご案内申し上げます。

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講演者　B.N.J. Persson 氏

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日時　６月１０日（月）午前１０時３０分から

[いつもと曜日が異なります]

場所　青山学院大学　理工学部　Ｌ棟６階　Ｌ６０３室

講演題目 Adhesion: Role of surface roughness, contact electrification and viscoelasticity, with applications to bioadhesion

Adhesion between solid bodies is an extremely important but also very complex topic. I first study the adhesion between smooth rubber balls and smooth and rough nominally flat hard substrate surfaces. The Johnson-Kendall-Roberts theory is used to analyze the ball pull-off force data, and the effective work of adhesion weff to propagate the interfacial opening crack is obtained for smooth and rough surfaces. We conclude that weff has contributions of similar magnitude from both the bulk viscoelasic energy dissipation close to the crack tip, and from the bond-breaking process at the crack tip. The pull-off force on the rough surfaces is strongly reduced compared to that of the flat surface, which we attribute mainly to the decrease in the area of contact on the rough surfaces and due to the elastic energy stored at the interface. Next, I discuss the contribution from contact electrification to the work of adhesion. Contact electrification is one of the oldest areas of scientific study, originating more than 2500 years ago when Thales of Miletus carried out experiments showing that rubbing amber against wool leads to electrostratic charging. In spite of its historical nature and practical importance, the contribution from contact electrification to the work of adhesion is not well understood. I present a general theory for the contribution from contact electrification to the work necessary to separate two solid bodies. The theory depend on the surface charge density correlation function which we deduce from Kelvin Force Microscopy maps of the surface electrostatic potential. For silicon rubber we discuss in detail the relative importance of the different contributions to the observed work of adhesion. Finally I present applications to bioadhesion, where natural selection during the time span of millions of years has developed unique adhesives organs which allow insects, some lizards and tree frogs to move on vertical rough and sometimes dirty surfaces.
