

# Was Thales right? Role of water in contact electrification

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**Abstract**— Static electricity develops on materials when they are brought into contact with each other. This phenomenon, also known as contact electrification (CE)<sup>1</sup> has long been applied in several useful technologies including photocopying, laser printing, and electrostatic separations. The studies on the mechanism that underlies CE dating back to Thales of Miletus remained poorly understood despite numerous studies trying to correlate charging with either electron<sup>2</sup> or ion transfer<sup>3</sup>. The studies on the effect of humidity should provide a better understanding on the mechanism of CE. However, again, the results<sup>4,5</sup> have been inconclusive suggesting that depending on relative humidity and the material properties of contacting materials, H<sub>2</sub>O contained in air can either promote or inhibit CE<sup>6</sup> mostly because experimental techniques used so far do not completely eliminate water from the atmosphere around the contacting materials.

The limitations on the experimental setup design for such studies are overcome with our simple but completely water-free setup. Here we perform all CE experiments under a highly non-polar liquid paraffin oil dried with sodium, desiccated with molecular sieves and maintained under dry, inert atmosphere. Water is completely expelled from polymer surfaces by preparation of the samples under dry atmosphere and keeping them under paraffin oil at all times. Under these extreme conditions, we show, CE between non-ionic polymers still can occur, presence of water is not vital for the CE phenomena. However, water plays an important role for charge stabilization on surfaces as discharging experiments in air and in paraffin oil indicated.

Role of water is an important part of revealing the mechanism of CE which is not only important in basic research but also for solving many problems in manufacture of polymeric products that are caused by static electricity on polymer surfaces.

This work was supported by the US Department of Energy, Office of Basic Energy Sciences as part of the Non-Equilibrium Energy Research Center (NERC), an Energy Frontier Research Center.

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