Paper Presentation

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ARTICLE

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Control of triboelectric charges on common polymers by photoexcitation of organic dyes

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RESEARCH ARTICLE

The Mosaic of Surface Charge in Contact Electrification

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Science 15 Jul 2011:
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Control of Surface Charges by Radicals as a Principle of Antistatic Polymers Protecting Electronic Circuitry

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Science 20 Sep 2013:
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SCIENCE ADVANCES | RESEARCH ARTICLE

APPLIED SCIENCES AND ENGINEERING

Minimizing friction, wear, and energy losses by eliminating contact charging

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ACS APPLIED MATERIALS & INTERFACES
Research Article
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Universal Nature-Inspired Coatings for Preparing Noncharging Surfaces

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Langmuir
Article
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Triboelectricity: Macroscopic Charge Patterns Formed by Self-Arraying Ions on Polymer Surfaces

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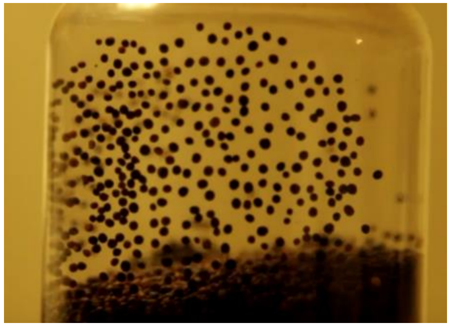
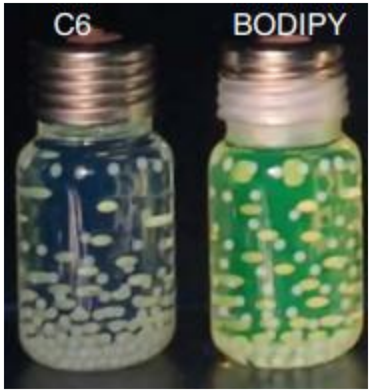
Relevance to lab

NCs/ NPs: Interaction of capping agent with glass/ plastic and how does it effect final outcome.
Dust: Charged particles interacts with surface/s.

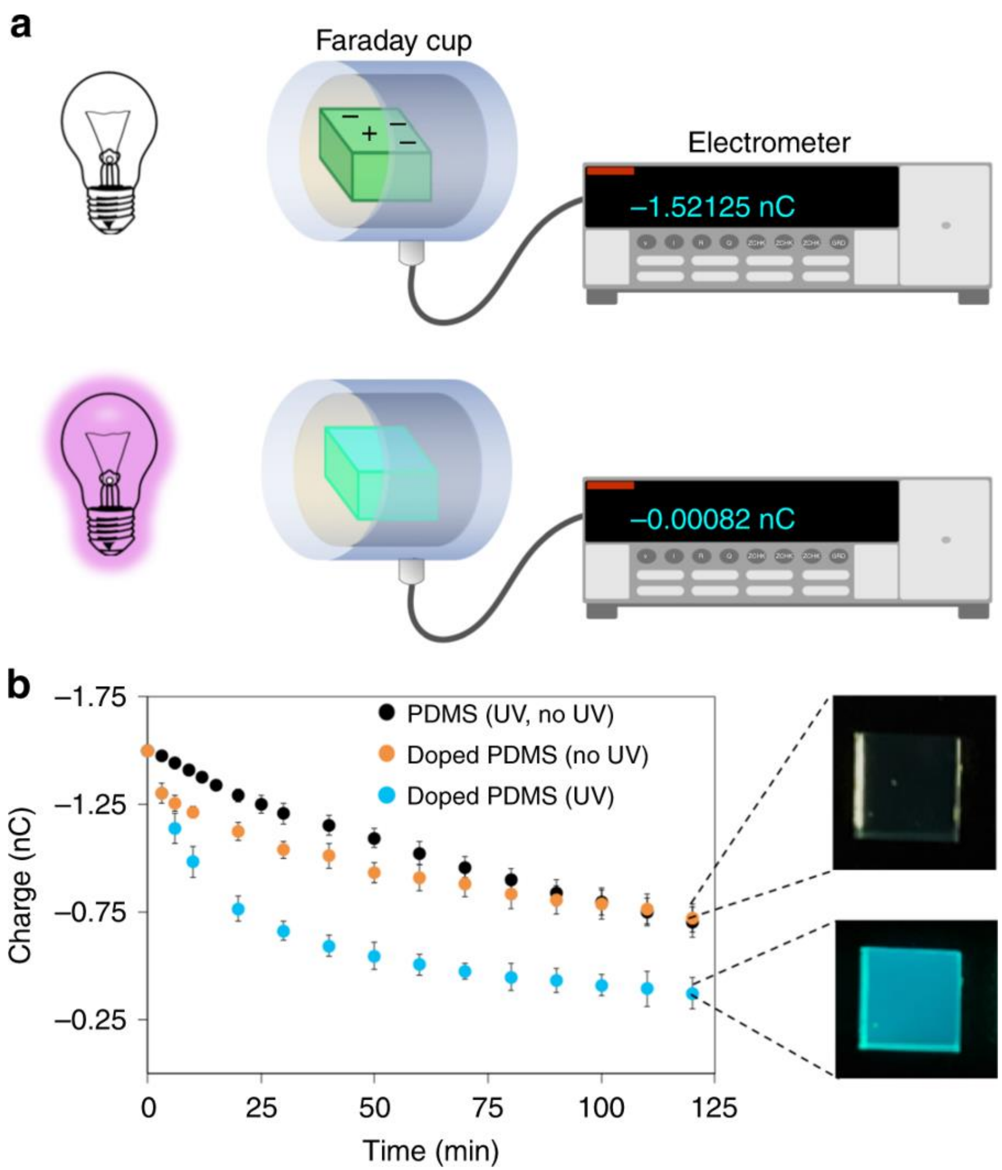


Mustard seeds in plastic bottle



Teflon beads in glass bottle

1. Mitigation of static charge using light in presence of organic dye.
2. Targeted discharging of polymers
3. Radicals helps in stabilizing the static charge. Removal of radical species destabilizes the surface charge leading.
4. How the dye may act as a mediator to interact with the mechanospecies (ions or radicals) produced during the mechanical action (contact or rubbing) of the polymer surfaces upon tribocharging?

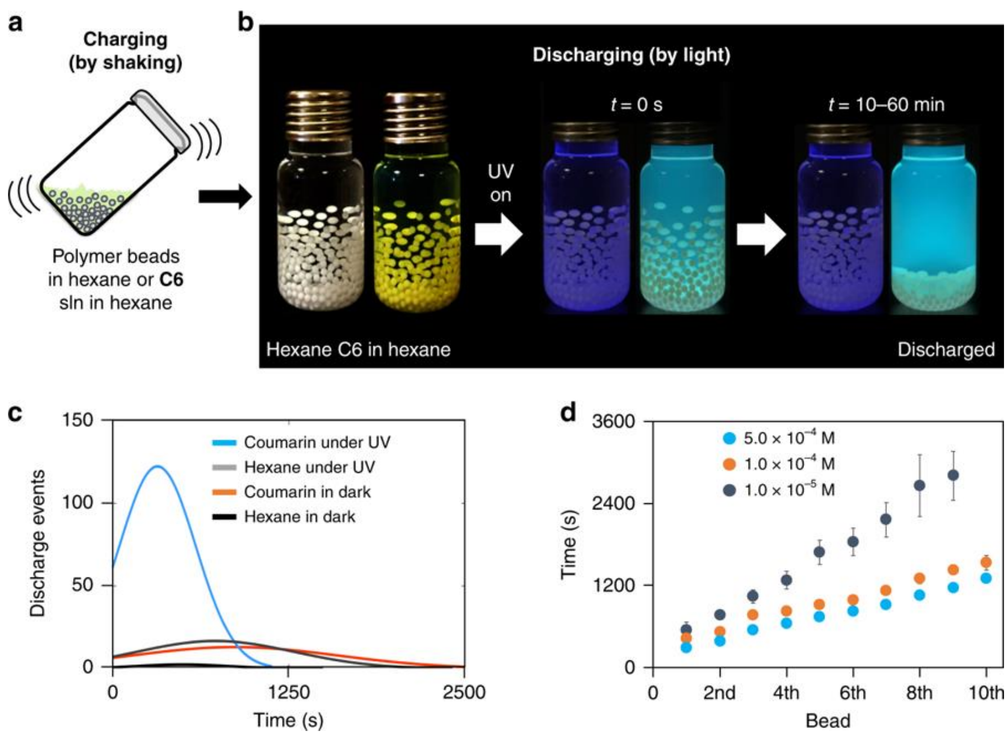


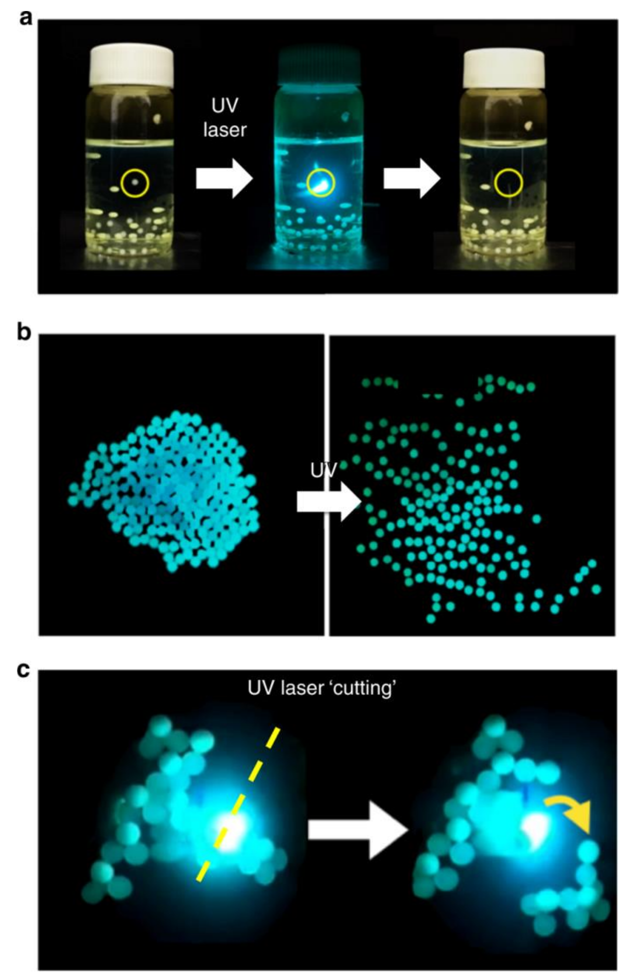
❑Undoped PDMS and Coumarin 6, C6 doped PDMS pieces (1 cm × 1 cm × 0.5 cm) were tested.

❑All polymer pieces, including controls, were contact-charged by touching clean aluminum foil surfaces several times.

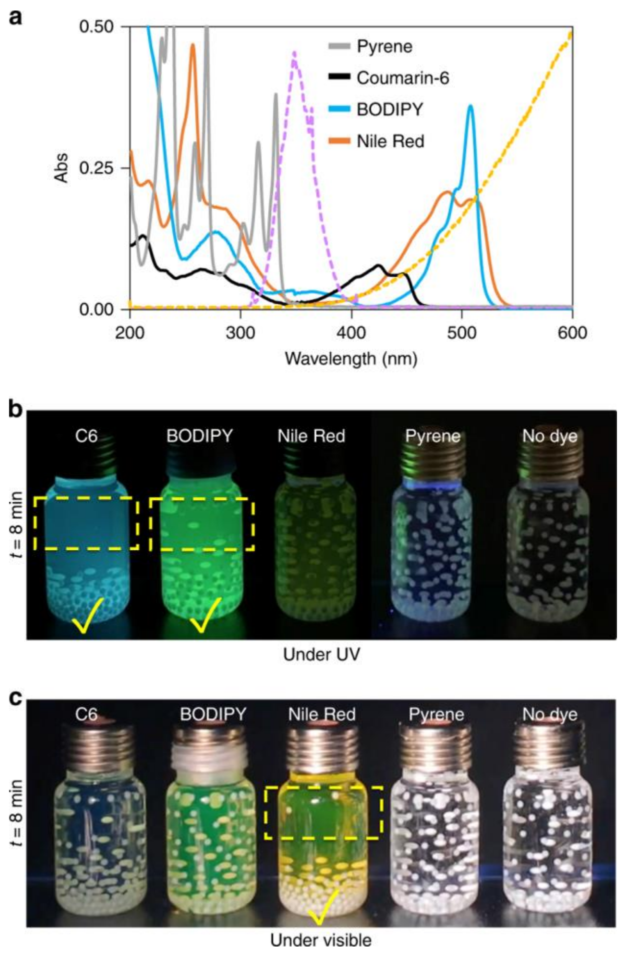
Light controlled discharging of tribocharged polymers

1. Light-initiated discharging of tribocharged polymers, we introduced 40/120 polymer beads (polytetrafluoroethylene (PTFE), 1.6 mm) in a 20 mL glass vial together with 15 mL dry hexane.
2. To prolong the discharging time HPLC grade hexane, to avoid any water, was used and relative humidity was kept as low as 25% - 30%.





Hexane, dielectric constant is 1.89.

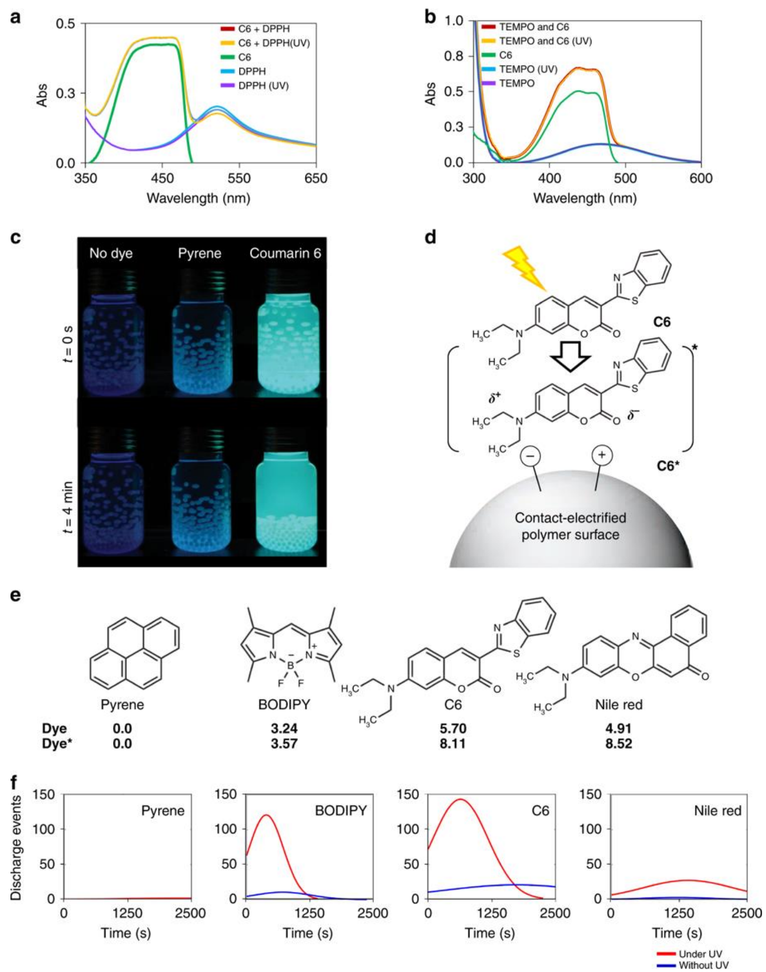


1. Pyrene,
2. Coumarin 6 (C6),
3. 4,4-Difluoro-1,3,5,7-Tetramethyl-4-Bora-3a,4a-Diaza-s-Indacene (BODIPY), and
4. 9-diethylamino-5-benzo[a]phenoxazinone (Nile Red)

Overlap between the wavelength of the light source and the absorption band of the dyes

The photoinduced discharging is more pronounced for the polymer beads in C6, BODIPY, and Nile red solutions than the ones in pyrene solution because of the differences between the polarity of the dyes.

1. Light does not causes increase in conductivity of beads or solution.
2. Solutions of stable radicals 1,1-diphenyl picrylhydrazyl (DPPH)30 and 2,2,6,6 -tetramethylpiperidine 1-oxyl (TEMPO) mixed with C6 in hexane was illuminated by UV light for several minutes.



Conclusion

1. Results provide new insights into a centuries old fundamental scientific question of how tribocharges are created and can be dissipated
2. Show a light controlled discharge of tribocharges on common polymers.
3. Spatial, temporal, and wavelength control for discharging of polymers.
4. It also provides a way to manipulate small polymeric objects and their assemblies by light.

THANK YOU