Effect of gas species and pressures on relaxation of tribo-electricity due to microgap discharge

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Abstract— **Air discharge is the principal origin of triboluminescence, which is a light emission phenomenon during friction of solids. Previous microscopic studies of triboluminescence have made it clear that the discharge occurs intermittently during friction at a micro-scale gap space around the real friction contact [1]. In other words, the gas discharge acts to reduce the static electricity generated by friction between solid surfaces. In this study, static electricity was measured during friction in a vacuum; by comparing it and measuring it in an ambient gas, we could evaluate the efficiency of charge reduction. In the case of friction between stainless steel and fused quartz, the charge density of the static electricity in a vacuum was 0.4 mC/m^2. In some ambient gases, the charge density becomes smaller as a result of the micro-gap discharge. According to the recent study [2], the residual rate depends on the ambient gas species and the pressure. The process of charge accumulation by friction and relaxation by gas discharge is shown in the figure. As a result of the previous study, the most effective gas for the reduction of static electricity was argon rather than nitrogen, dry air, or humid air. Under argon ambient gas at 1 atm, the residual charge was around 0.5% of the initial static electricity, i.e., the measurement in a vacuum. We are continuing to investigate more effective conditions for reducing triboelectricity.**

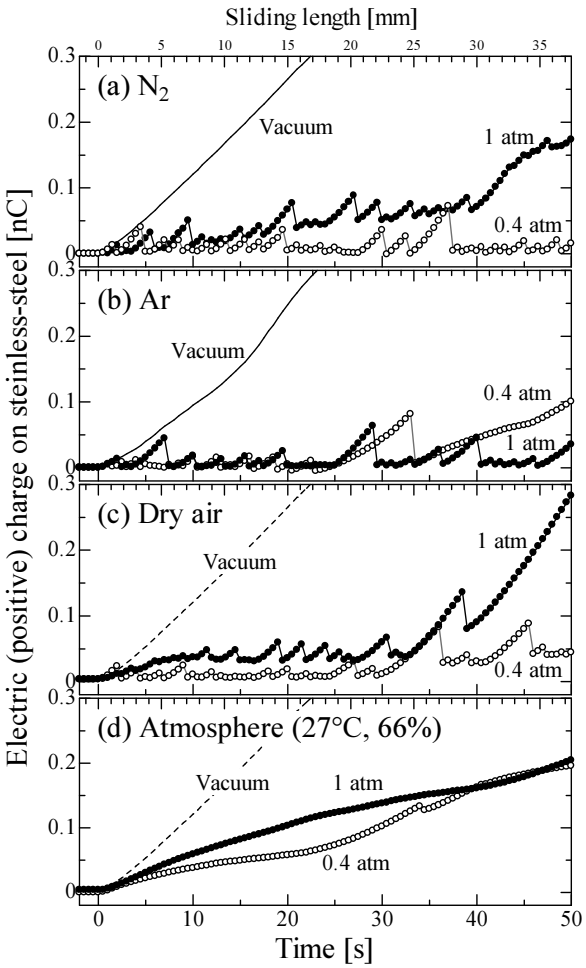

Figure. Charge accumulation during friction in a vacuum and ambient gases at different pressures [2]

REFERENCES

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[2] T. Miura, "Observation of charge separation and gas discharge during sliding friction between metals and insulators", J. Phys.: Conf. Ser. vol. 646 p012057, (2015).