

Analysis on Stick and Slip Behavior of Cleaning Blades

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Abstract

We have previously reported that in a leading-type blade cleaning systems for electrophotography, the lifetime of cleaning blades depends on the rebound resilience (R) of polyurethane rubber.¹ In this paper, we examine the general profile of the cleaning performance (cleaning ability and lifetime of cleaning blades) in terms of the stick-slip behavior of the cleaning blade. The rate of abrasion α is defined as wear volume per unit friction length. A theoretical analysis of fatigue wear shows that α is inversely proportional to the product, $N_0 L_0$, of the number (N_0) of friction vibrations stripping off small fragments of polyurethane rubber and the friction length (L_0) per one cycle of vibration. Laboratory tests for fatigue fracture of polyurethane rubber show that N_0 is proportional to the $-m$ -th power of $(\mu W^{0.47})$, where μ is the friction coefficient and W is the weight of the cleaning blade onto the photoreceptor surface. The cleaning blade edge has a stick-slip behavior against the surface of the photoreceptor. A new model, which takes into account viscoelastic behavior, is applied to the friction length. A cleaning blade edge once stretched by photoreceptor surface contracts with a relaxation time τ

during the slip motion and $L_0 \propto -\ln R$ is deduced. During the slip process, the blade forces remaining toner particles to move against rotating direction of photoconductive drum. In encounters greater possibility of toner particles going through blade nip during the slip processes. Therefore, the cleaning ability is proportional to $1/L_0$ i.e., $-1/\ln R$.

Biography

Kuniki Seino received his M.S. degree in Physics in 1967 and a D.Sc. in Physics in 1972 from the Kwansai Gakuin University in Japan. He joined Minolta Co. Ltd., in 1967, where he has been engaged in research on photoreceptors and electrophotographic imaging processes. From 1991 to 1996, he managed the development of analog and digital copying machines including full color equipment. He is Senior Advisor for Imaging Technology to Minolta Co., Ltd. He is a member of the IS&T and the Imaging Society of Japan.

*See NIP17 Proceedings, 2001, pp. 633-638
for full paper.*