

Arc root mobility on piezo-actuated contacts in miniature circuit breakers

K. Pechrach, J.W. McBride, P.M. Weaver*

School of Engineering Science
Electro-Mechanical Research Group
University of Southampton UK, S017 1BJ
*Servocell PBT Ltd, 1 Astra Centre, Harlow, UK, CM20 2BN
E-mail: K.Pechrach@soton.ac.uk

Abstract - A novel contact opening mechanism has been developed using a piezo-ceramic actuator to open the contacts in a low contact opening velocity circuit breaker. The arc control on the contacts is critical for successful current interruption (10^3 - 10^4 A) in low voltage (<250V) devices. Previous work has shown how arc root commutation from the contact region into the arc chamber is affected by arc chamber materials, contact materials and the gap behind the moving contact for contact velocities in the range 10 ms^{-1} and 1 ms^{-1} . This work is further extended by using a commercially available piezo-ceramic actuator to open the contacts. Contact opening speeds are assessed and the arc root mobility is characterised under this operating regime. A flexible test apparatus is used to vary the arc chamber geometry. A solid-state high-speed arc imaging system and pressure transducers are used to gather data on the arc mobility and the gas dynamic interactions occurring during the piezo actuated contact opening. New experimental results are presented on arc root velocity, arc root motion, arc imaging and pressure measurement in the arc chamber with the piezo actuated contact opening. Results are correlated using a semi-empirical model of the arc motion. These results can be used to improve the design of high current low voltage circuit breakers suitable for piezo-ceramic actuation.