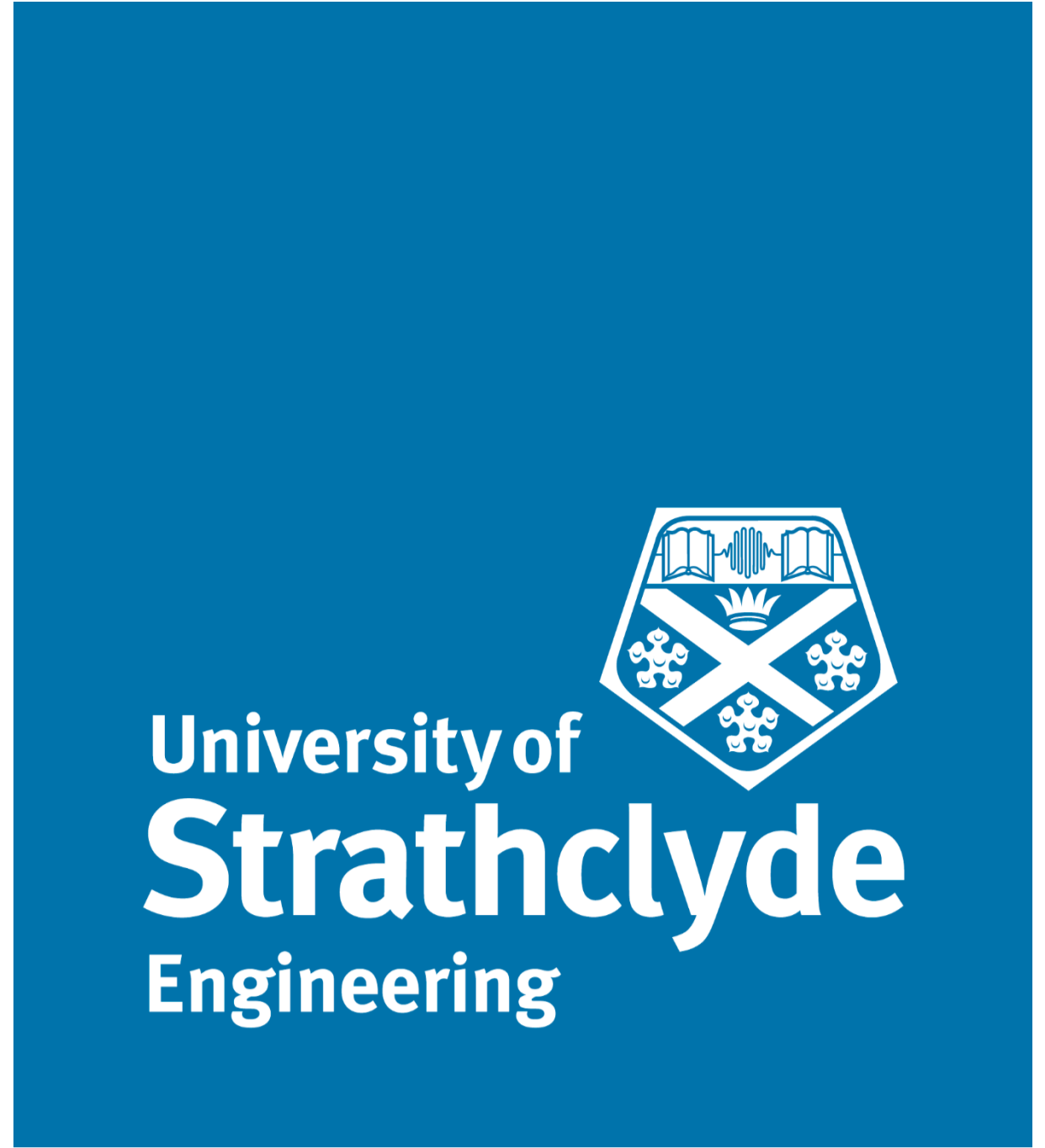


# Effect of Surface Deviation of Solid Insulation on Impulsive Flashover Voltages Under Varying Environmental Conditions

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**Introduction:** In pulsed power engineering, the modification of dielectric surfaces is a potential method in order to increase the flashover strength of solid insulation. In this work, dielectric materials are subjected to a knurled finish, where small indentations are machined on to the surface resulting in quick consistent modification. These flashover voltages from the knurled dielectric spacers have been compared to spacers with a 'smooth' machined finish. The three materials which have been tested are HDPE (High Density Polyethylene), Delrin (Polyoxymethylene) and Ultem (Polyetherimide). The materials were tested under a 100/700 ns impulse voltage. Cylindrical spacers made of these materials were located in the center of a parallel-plane electrode setup in air, which provided a quasi-uniform electric field distribution. Breakdown tests published in this work were performed in a sealed container at air pressures of -0.5, 0 and 0.5 bar gauge, with relative humidity levels of <10% RH and >90% RH.

Test-cell setup with resultant quasi-uniform electric field from the geometrically symmetrical electrode setup

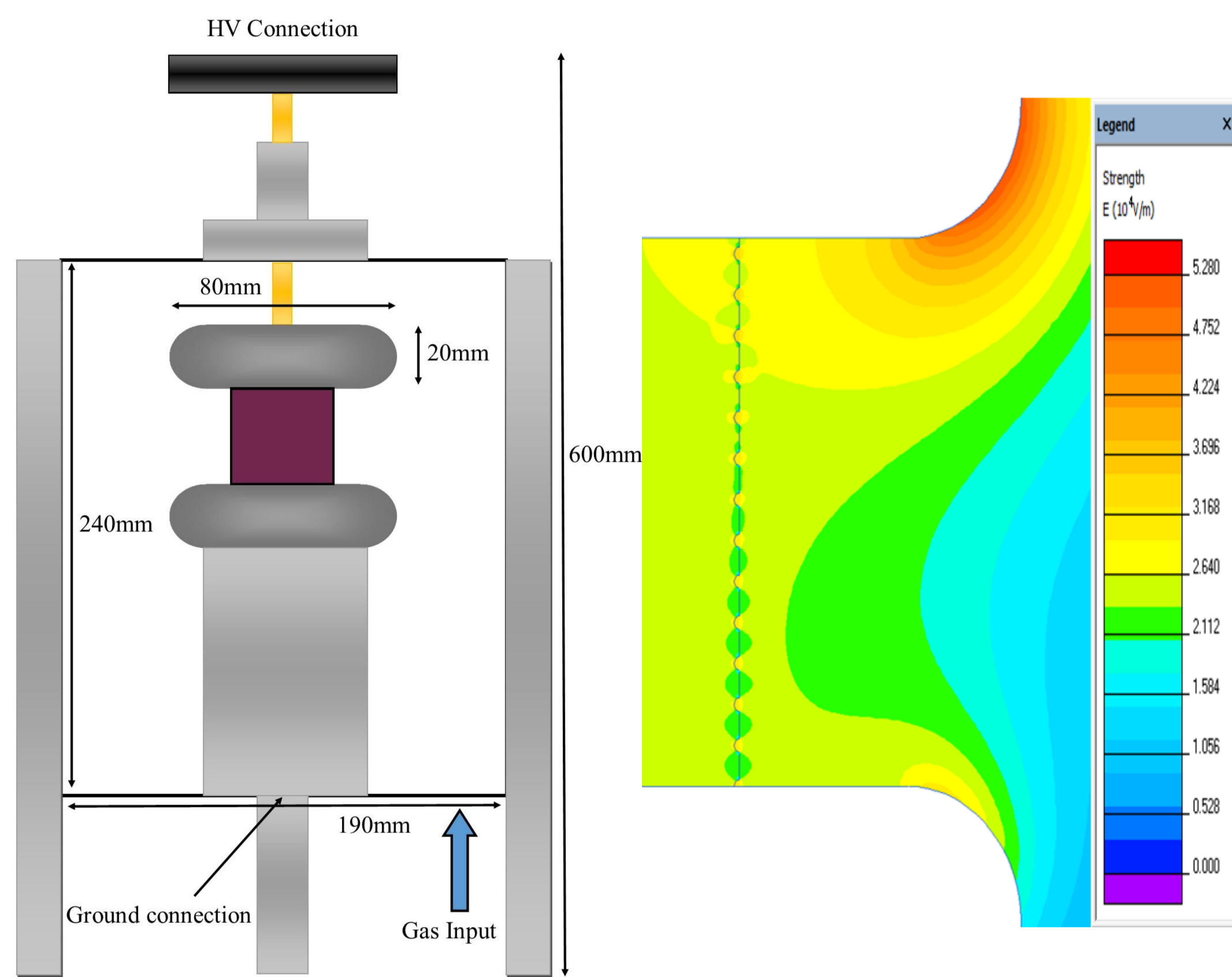
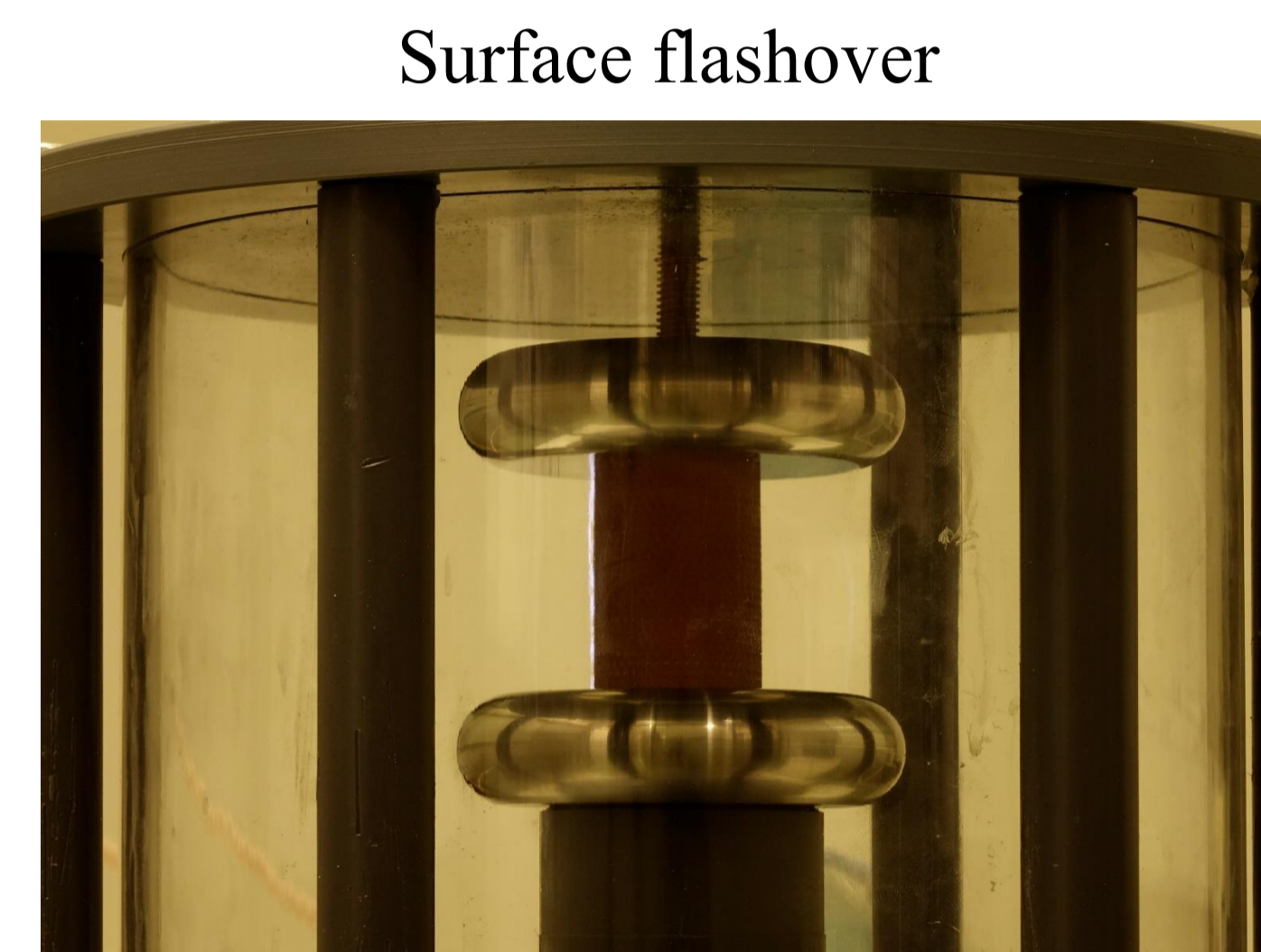
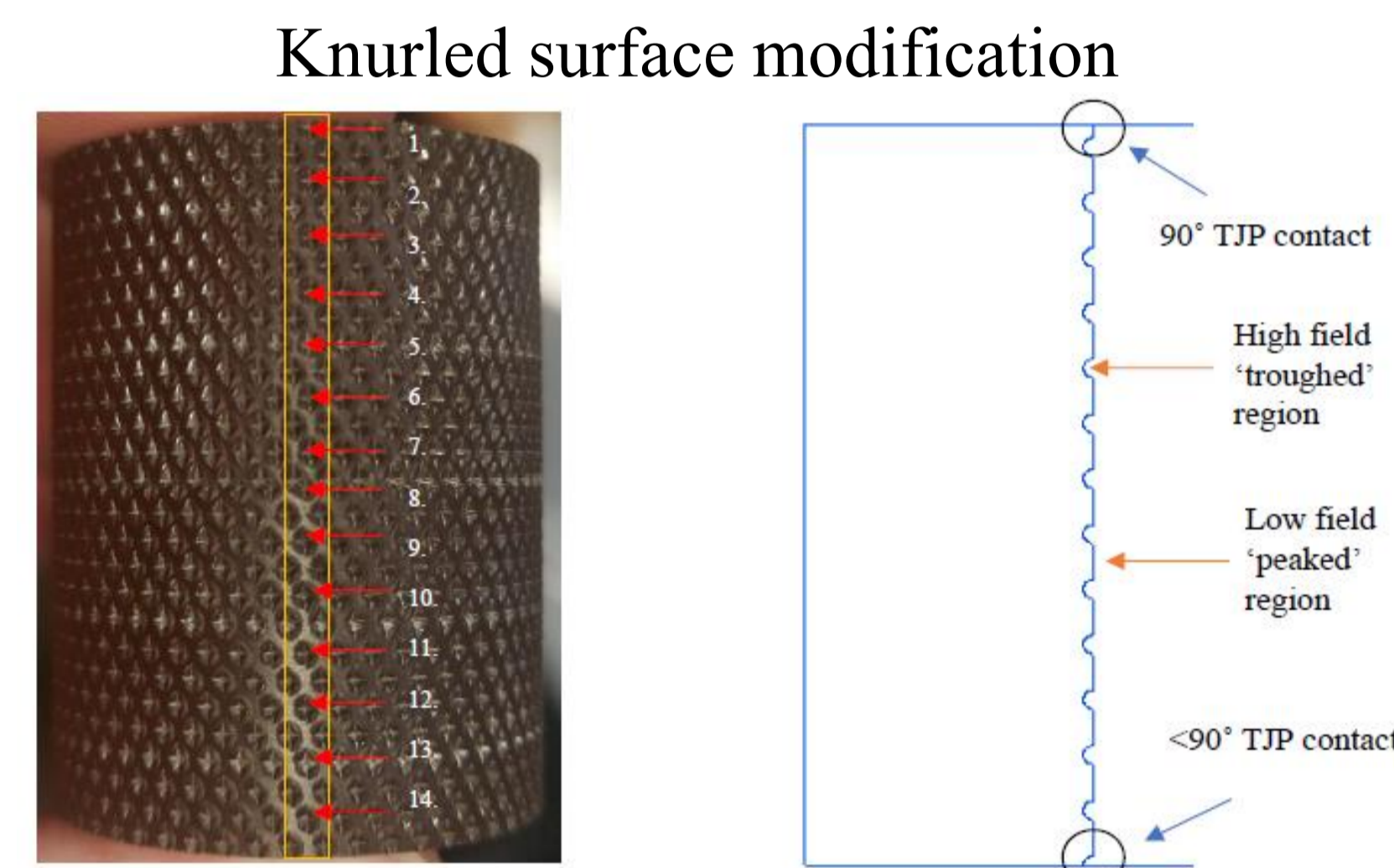
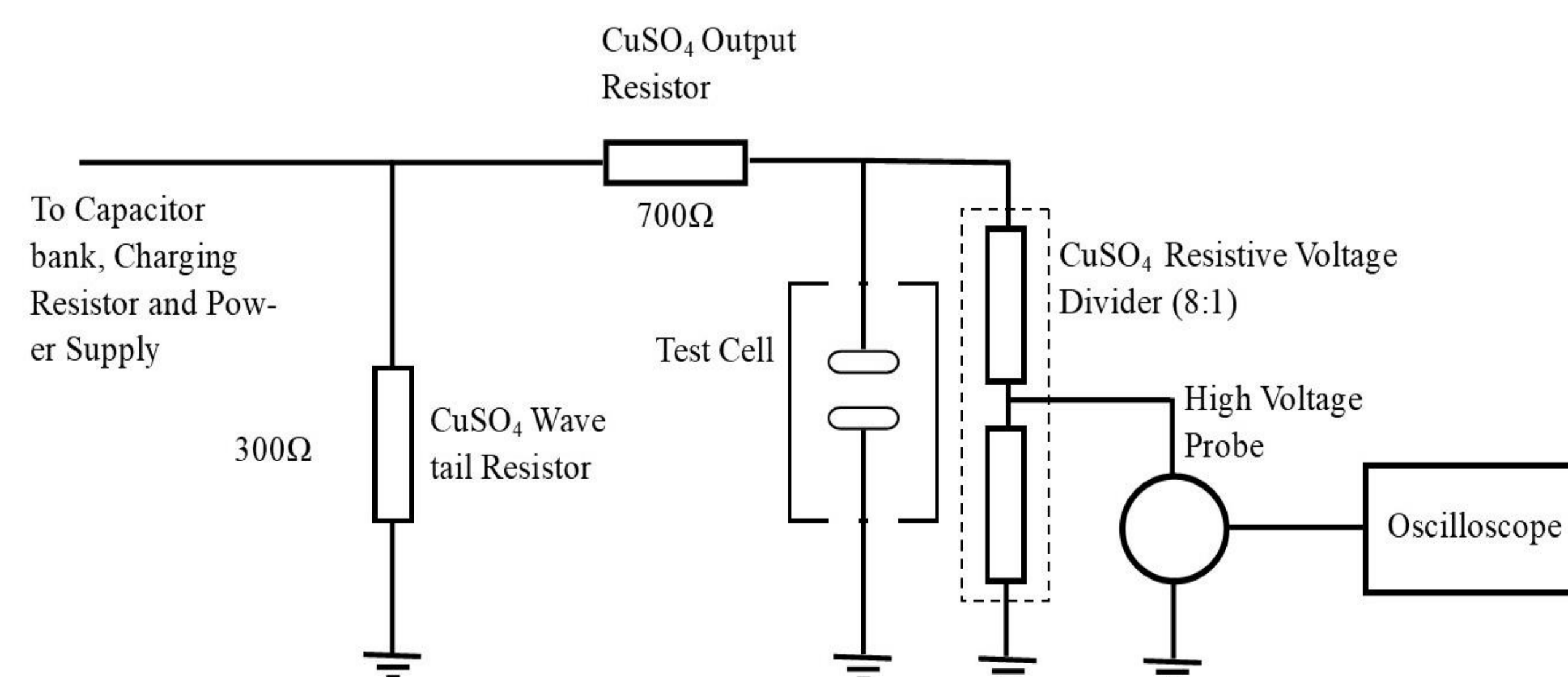
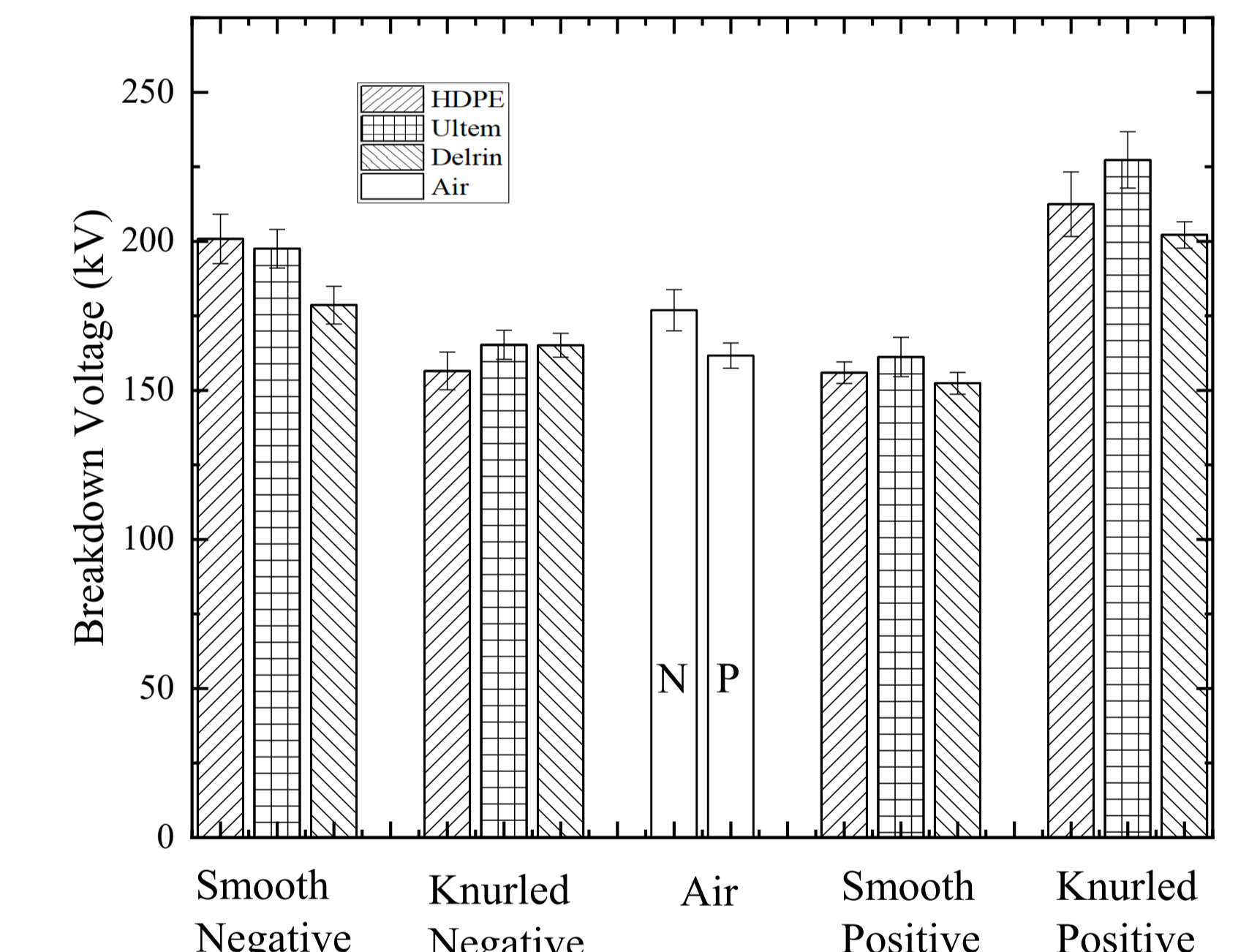
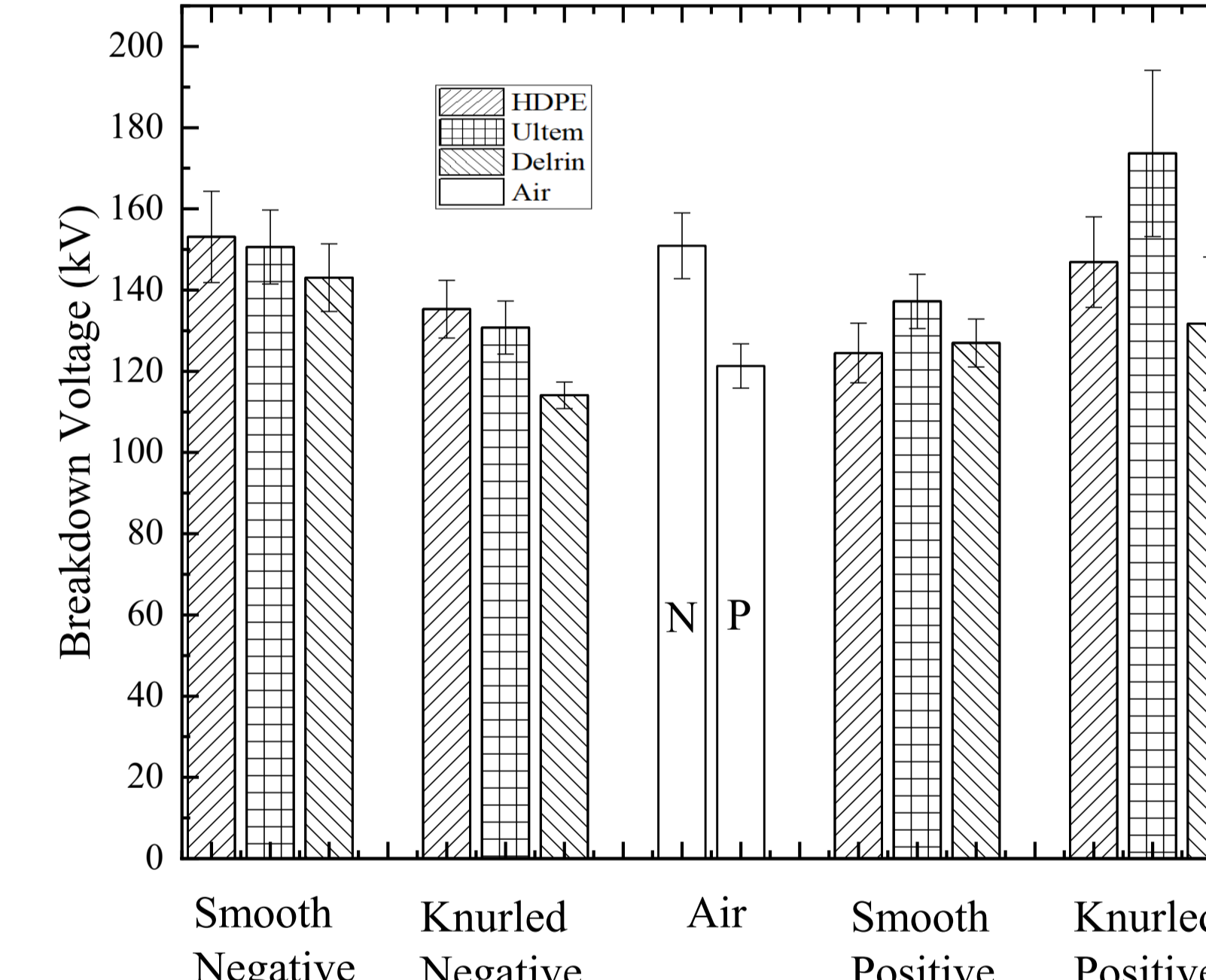
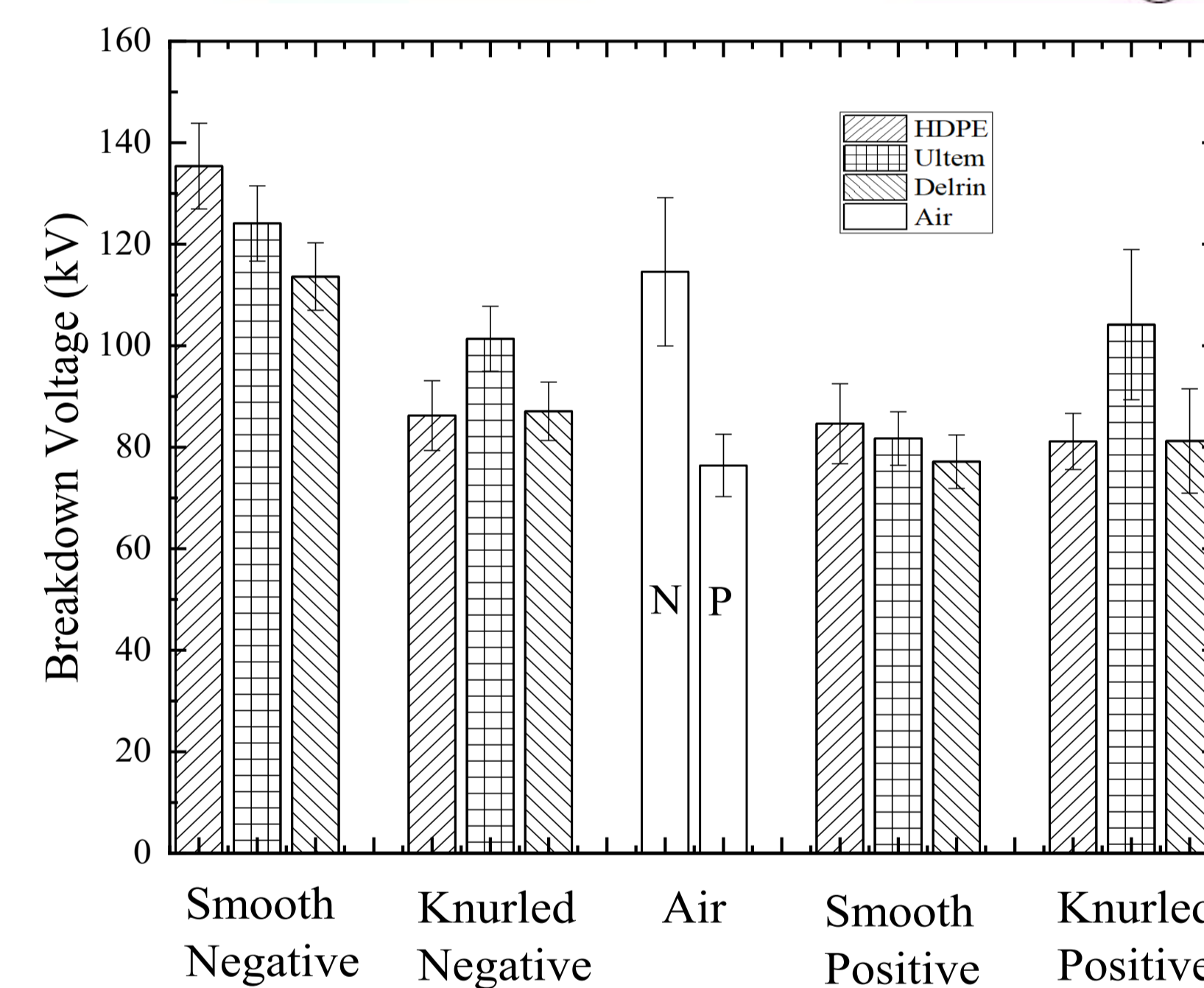


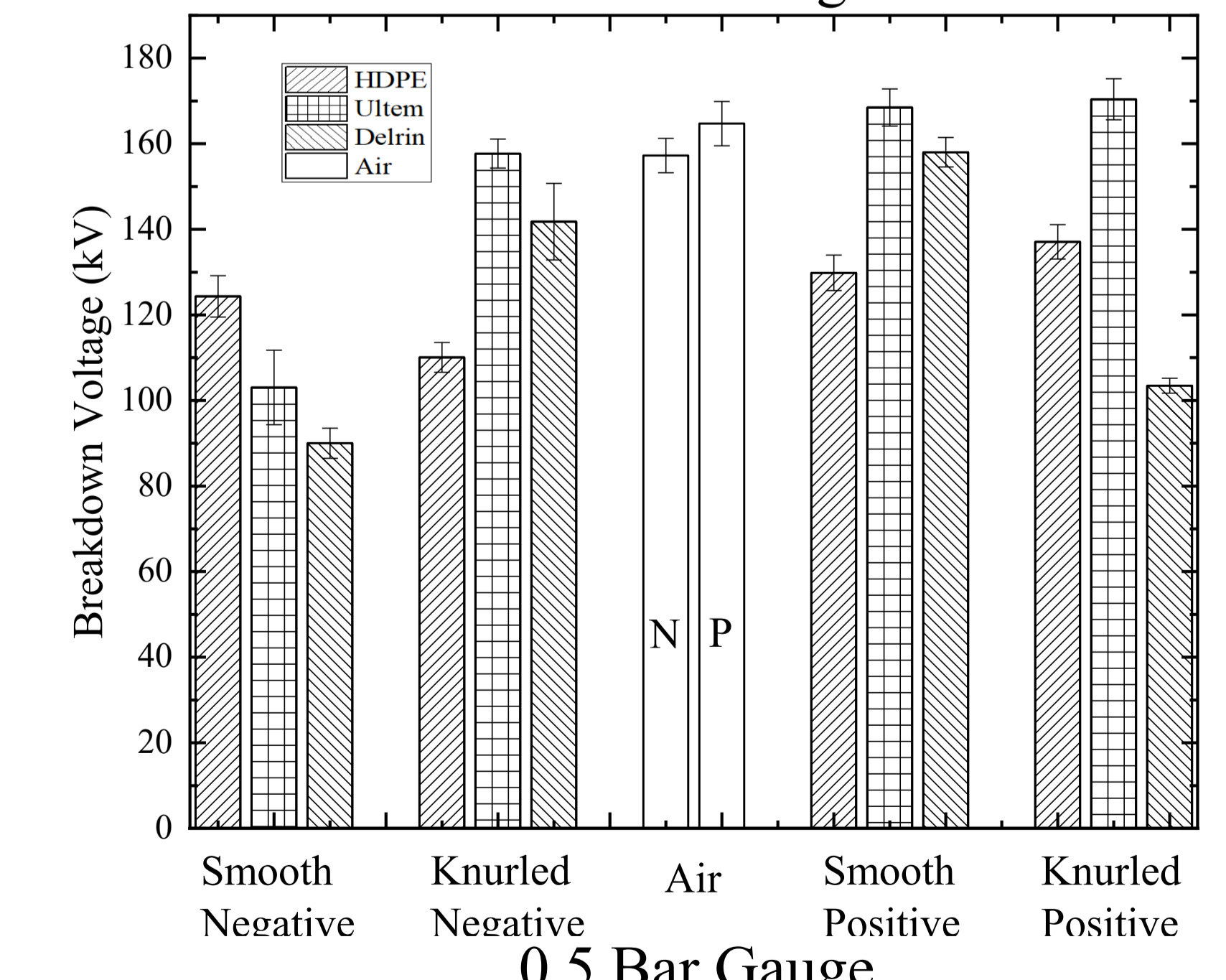
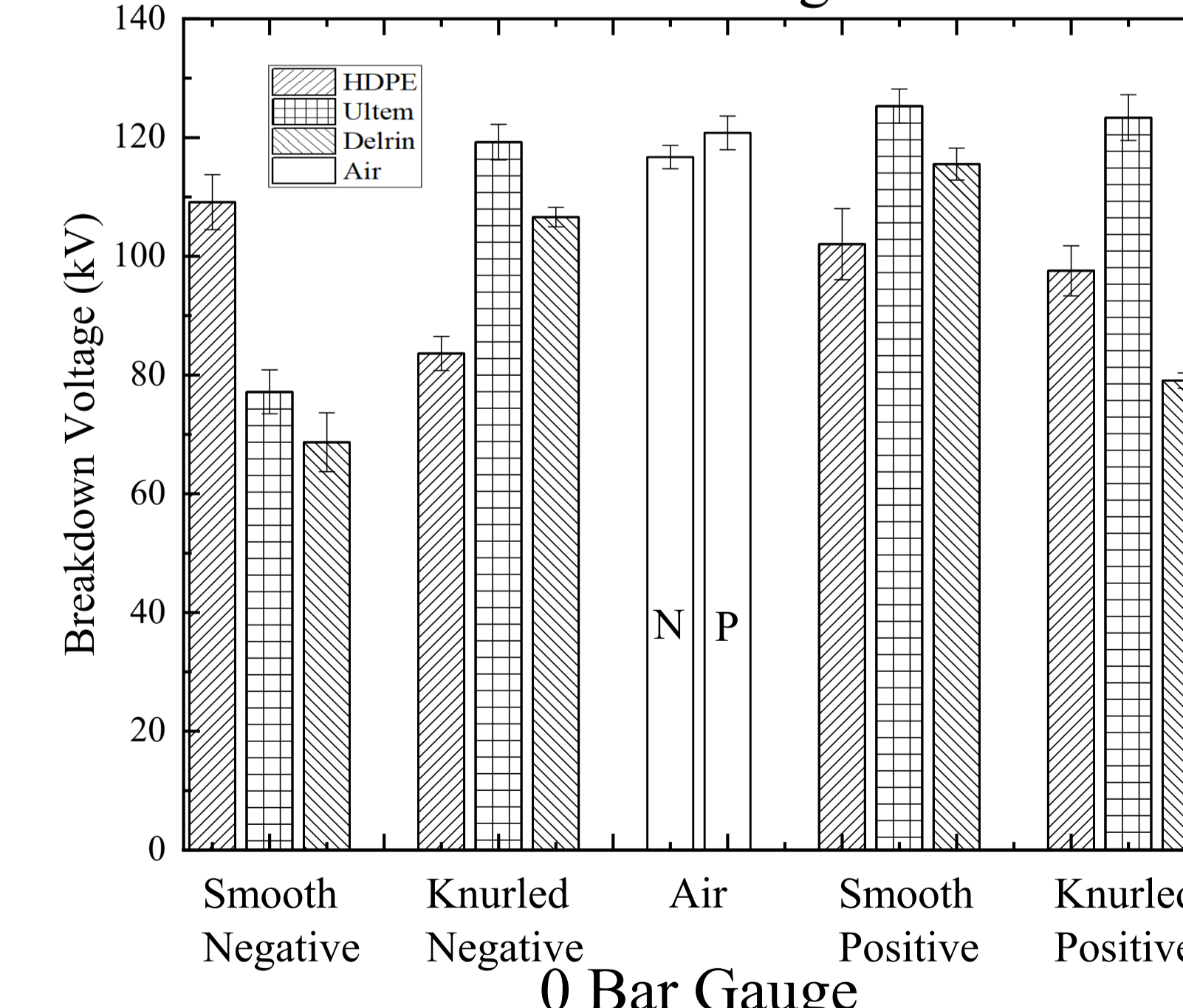
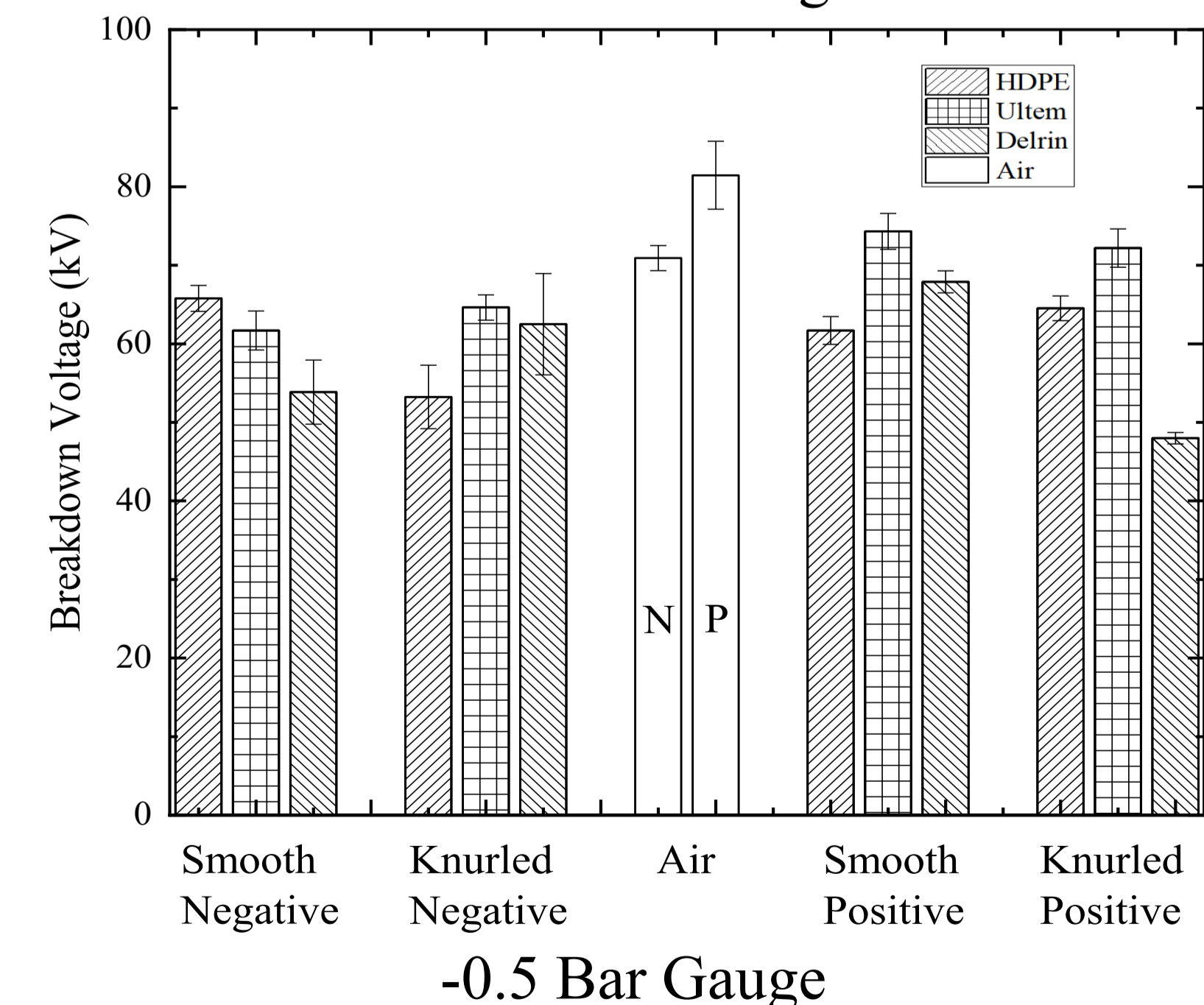
Diagram of circuit used in order to produce 100/700 ns impulse



<10% RH



>90% RH



**Discussion:** At <10% RH, negative breakdown voltages were higher for an open-air gap, and for gaps including smooth machined surfaces, than for gaps including knurled surfaces, on average, for all air pressures. Positive breakdown voltages were higher for gaps including knurled surfaces than for an open-air gap, or for gaps including smooth surfaces, on average, for all air pressures. For positive polarity, the benefit of knurling the sample surfaces is higher at 0.5 bar gauge compared to at the lower tested air pressures. At >90% RH, for an open-air gap the positive breakdown voltages are higher than negative however not statistically significant. For negative polarity, the breakdown voltages show overall, knurled has a higher breakdown voltage compared to smooth surfaces for Ultem and Delrin. For positive polarity, smooth machined surfaces have a similar voltage than knurled surfaces for HDPE and Ultem. However, It was found that Delrin has a higher voltage for smooth in comparison to knurled.