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Laser electric field measurement in open-air dielectric barrier discharges TSUYOHITO ITO, TATSUYA KANAZAWA, SATOSHI HAMAGUCHI, Osaka University — Electric field induced coherent Raman scattering (E-CRS) measurement is a promising technique for measuring electric field in high-pressure environments. In this study, the discharge initiation mechanism of nanosecond dielectric barrier discharges (DBDs) in open air has been examined with time dependent measurement of the discharge electric field by E-CRS. Two pulsed ns laser beams (532 nm and 607 nm) are employed. In the presence of nitrogen molecules the two laser beams together with the electric field induce a coherent IR signal at a wavelength of 4.29 μm and the normal coherent anti-Stokes Raman scattering (CARS) signal at 473 nm. The ratio of these two signals (IR and CARS) is a function of the electric field strength, so that the magnitude of the electric field can be estimated. Our experimental observations have revealed that, in the pre-breakdown phase of a nanosecond DBD discharge, the externally applied fast-rising electric field is strongly enhanced near the cathode due to large accumulation of space charge, which then strongly enhances ionization near the cathode. This process is essentially different from the well-known Townsend mechanism for slower discharges.

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