

Modification of hardwood samples in the flowing afterglow of N₂–O₂ dielectric barrier discharges open to ambient air

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The effect of O₂ addition in the gas feed of an open-to-air N₂–O₂ dielectric barrier discharge (DBD) on the surface modification of sugar maple hardwood samples is reported. After treatment by N₂–O₂ plasma, an increase of the contact angle with water and a decrease of the contact angle with diiodomethane was observed. X-ray photoelectron spectroscopy and Fourier-transform infra-red analyses further reveal a decrease of the O/C as well as increase of the C=O peak and surface aromaticity. When O₂ is added to the nominally pure N₂ DBD, the discharge transits from a homogeneous regime to a filamentary regime with increased dissipated power and neutral gas temperature. As a result, surface modification by N₂–O₂ plasmas becomes similar to those occurring under a low-temperature heat treatment of wood surfaces. In such conditions, a mechanism involving the thermally-activated deacetylation and depolymerisation of hemicelluloses and cross-linking between lignin and furfural and hydroxymethylfurfural, leading to the increase of wood hydrophobicity is proposed.