Dielectric and ultrasonic properties of rubber wood. Effect of moisture content, grain direction and frequency

ABSTRACT

Dielectric properties of rubber wood have been studied at low and microwave frequencies with different moisture content and grain direction. The ultrasonic properties were studied with pulsed longitudinal waves of frequency 45 kHz, Two anisotropic directions have been considered for this study ð parallel and perpendicular to grain. The low frequencies were of 0.01, 0.1, L0, 10 and 100 Hz and microwave frequencies were of 1, 2.45, 6, 8, 10, 14 and 17 GHz. The moisture content affected the dielectric constant and dielectric loss factor both at low and microwave frequencies? The moisture content above 30% showed little influence on dielectric properties whereas it increases linearly from 0 to 30% in both the grain directions at low frequencies. A continuous increase of dielectric properties was obtained with the increase of moisture content at microwave frequencies and the trend becomes concave upward. Dielectric properties increase as the frequencies increase except dielectric loss factor at microwave frequencies where reverse trends were observed. Little change of dielectric loss factor was obtained at frequencies above 6 GHz. The parallel to grain direction showed higher dielectric constant and dielectric loss factor compared to perpendicular to grain direction. This dielectric anisotropy of wood may be attributed due to the microscopic, macroscopic molecular as well as chemical constituents of wood. Ultrasonic properties were also affected considerably by the moisture content and grain direction. The dried wood showed higher ultrasonic velocity and elastic stiffness constant compared to green wood. The parallel to grain direction exhibits higher ultrasonic velocity and elastic stiffness constant than perpendicular to grain.

Keyword: Dielectric; Ultrasonic properties; Rubber wood; Microwave frequency; Moisture content; Grain direction