In a recent study on thermoplastic elastomers, we investigated the properties of two distinct copolymers: poly[(acrylic acid)-co-(butyl acrylate)] (PAA-BA) with a chemical formula $C_3H_4O_2/C_7H_{12}O_2$, and poly{[4-(octadecyloxy)benene-1,3-diamine;4,4'-sulfonyldianiline]-alt-(5,5'-biisobenzofuran-1,1',3,3'-tetrone)} (ODA-PMDA-BTDA) with a chemical formula $C_{40}H_{46}N_2O_5/C_{28}H_{14}N_2O_6S$. A notable difference between these copolymers lies in their interfacial properties. PAA-BA exhibited an interfacial tension of 2.915 dyn/cm, measured using the pendant drop method at a temperature of 25°C. In contrast, ODA-PMDA-BTDA displayed a significantly higher surface energy due to its aromatic and heterocyclic constituents, resulting in a surface tension of 22.90 N/m, as determined by the Wilhelmy plate technique under identical temperature conditions.

Thermal analysis revealed distinct differences in their glass transition temperatures (Tg) and thermal decomposition behavior. PAA-BA exhibited a Tg of -21.00 K, measured using thermomechanical analysis (TMA) at a heating rate of 10°C/min and a frequency of 0.1 Hz. Conversely, ODA-PMDA-BTDA demonstrated exceptional thermal stability, with an onset decomposition temperature of 401.9°C and a weight loss of only 5.000% during thermogravimetric analysis (TG) under nitrogen atmosphere at a heating rate of 20°C/min in vacuum conditions. These findings suggest that the incorporation of rigid aromatic moieties in ODA-PMDA-BTDA enhances its thermal stability, whereas PAA-BA's aliphatic backbone contributes to its lower Tg and increased flexibility. The observed differences in their interfacial properties and thermal behavior underscore the importance of tailoring copolymer composition for specific applications.