LOW SURFACE ENERGY, PHOTOCATALYTIC AND ANTIMICROBIAL APPROACHES TO FOULING IN FOOD AND BEVERAGE PROCESSING

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ABSTRACT

Antifouling coatings were deposited using industrially compatible vacuum deposition processes, reactive Closed Field UnBalanced Magnetron Sputter Ion Plating (CFUBMSIP) and plasma assisted chemical vapour deposition (PACVD). Two different approaches were taken to prevent and/or increase resistance to fouling in food and beverage processing. The first approach involved the use of hydrophobic, low-energy coatings as fouling-release surfaces; the second was the use of photocatalytic and antimicrobial coatings as self-cleaning surfaces. Hydrophobic siloxane coatings were deposited using PACVD method from mixtures of hexamethyldisiloxane (HMDSO) with oxygen and/or nitrogen. These coatings presented low energy surfaces which provided antifouling and fouling release properties as a result of the low adhesive forces between the foulant and the surface. The photocatalytic and antimicrobial approach involved the use of titanium dioxide (TiO_2) and doped TiO_2, deposited using reactive magnetron sputtering. The coatings were deposited from elemental targets with excellent mechanical and photocatalytic properties without the need for further annealing. Stainless steel and Ag were used as dopants. Whilst steel had a single function of improving the visible-light activity of TiO_2 through lowering its band gap, Ag had a dual function by also imparting antimicrobial properties to the surface.