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| **Title:** | Low-temperature sol-gel synthesized TiO2 with different titanium tetraisopropoxide (TTIP) molarity for flexible emerging solar cell | | |
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| **Abstract:** |  |
| The tetragonal crystal structured anatase titanium dioxide (TiO2) has been conventionally used as an electron transport layer in emerging solar cells. Conventionally, a high-temperature process above 450 °C is indispensable to form crystallized TiO2 films with a well-defined mesoporous structure. Due to the temperature limitations of the flexible polymer substrates, notably below 150 °C, such a high-temperature process is ineffective for flexible emerging solar cells. Currently, cutting-edge and high-potential solar cells are flexible dye-sensitized and perovskite solar cells which are preeminent in mass production due to their roll-to-roll printing technique. Hence, this study explores a low-temperature synthesis of crystallized TiO2 layers using the sol-gel method with various precursor concentrations of titanium tetraisopropoxide (TTIP). Then, the crystallized TiO2 was deposited with a simple yet low-cost spin-coat technique on flexible substrates (ITO/PET). A thorough scrutinization of TTIP concentration is crucial in identifying the potential of TiO2 films through comprehensive studies of elements aspects of structural, optical and electrical properties. The synthesized TiO2 films with a TTIP concentration of 0.5 M demonstrated a high porosity microstructure with exceptional transmittance, allowing a large number of photons to penetrate and thereby resulting in an enhanced charge carrier conduction mechanism. In addition, the direct optical bandgap is reduced with increasing TTIP molarity, proving the involvement of particle factors influencing photocatalytic activities. Moreover, electrical analysis proved that all the correlation features resulted in remarkably low sheet resistance and conductivity of 0.4 MΩ/sq and 0.1194 mS/cm, respectively. It can be conjectured from this study that the synthesis of crystallized TiO2 at low-temperature conditions with a certain TTIP molarity is successful and has resulted in an enhancement of the electron conduction mechanism, particularly for flexible emerging solar cell applications. | |