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α-TITANIUM PHOSPHATE DERIVED FROM ILMENITE BEACH SAND AS A NOVEL SENSING MATERIAL TO DETECT CHLORINE GAS AT ROOM TEMPERATURE

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Ilmenite ($FeTiO_3$) is the major constituent of Pulmoddai beach sand in Sri Lanka and is considered one of the significant ore deposits, which is widely used in synthesizing titanium compounds. The present study focused on the α-titanium phosphate (α-TiP) synthesised through KOH roasting and H_3PO_4 leaching processes as a chlorine gas sensing material. As a gas sensing material, α-TiP is important because of the unique crystal structure with interlayer spaces and high adsorption capacity. Moreover, as minor components of the sensing material, natural graphite was used to obtain electrical conductivity, and carboxy methyl cellulose (CMC) was used as a film-forming material. The sensor electrode was fabricated using the doctor blade method. The extremely toxic nature of chlorine gas to human health is increasing the demand for the development of chlorine gas sensors at room temperature. A custom-made gas sensing chamber was used to investigate the sensing characteristics of chlorine gas, and a voltage divider circuit and LabJack apparatus were used to take voltage response measurements. The synthesised α-TiP and the sensing material were characterized using XRD, FTIR, and Raman spectroscopy. The electrical properties of the sensing material were analysed using the four-probe conductivity meter, resulting in the ohmic behaviour with a good conductivity of 0.31 S/m. From (20 – 1000) ppm, chlorine gas concentrations were checked using the fabricated sensor. It shows a good sensitivity of 0.185 mV/ppm. The average response time is 2 to 3 min, and the recovery time is 1 to 3 min. The sensor has good selectivity towards the chlorine gas and stability for ageing. The experiments are in progress to reduce the response time and recovery time by modifying the sensor.

Keywords: α-titanium phosphate, Chlorine gas, Gas sensor, Ilmenite, Room temperature