Chemeca2026
Innovate. Integrate. Impact.
28 – 30 September 2026
Melbourne, Australia

Hazards
Australasia 2026

Chemeca 2026 and Hazards Australasia
28 – 30 September, Melbourne, Australia

NOVEL HYDRODYNAMIC AND CHEMICAL APPROACHES TO ULTRAFINE GRAPHITE FLOTATION

Jack Michael Walsh, William Skinner, George Blankson Abaka-Wood

The University of Adelaide

jack.walsh@adelaide.edu.au

ABSTRACT

Graphite, a planar form of carbon, is critically important to the renewable energy transition due to its pivotal role in the production of lithium-ion batteries. Graphite deposits are classified by flake size. Flake graphite, traditionally used for the production of lithium-ion batteries, refers to graphite with flake length greater than 40 μm and less than 4 cm. Microcrystalline graphite has a flake length less than 40 μm and is typically used for low-grade applications due to difficulty in producing battery-grade concentrate from these deposits.

Microcrystalline graphite constitutes approximately 75% of global graphite reserves and 54% of identified graphite resources. In South Australia, it accounts for at least 50% of discovered graphite resources. Froth flotation is the primary beneficiation method for graphite, as it exploits the inherent hydrophobicity of graphite surfaces to achieve selective separation from gangue minerals. Typically, froth flotation of microcrystalline graphite is challenging because of reduced particle hydrophobicity and momentum of the particles greatly diminish successful particle–bubble attachment.

In this study, flotation experiments were conducted on two model graphite mixtures comprising graphite, kaolinite, and quartz: one of conventional particle size (D_{80} = 125 μm) and one ultrafine (< 20 μm). Both a conventional mechanically agitated flotation cell and a Reflux Flotation Cell® were employed to evaluate flotation performance. A kerosene collector system was compared with a sodium oleate system, both in the absence and presence of starch and sodium silicate. Complementary zeta potential, contact angle, and FTIR analyses were performed to elucidate the surface interactions between the minerals (graphite, kaolinite, and quartz) and the collectors.

The present study will demonstrate the differences in flotation performance between kerosene and sodium oleate systems, where the flotation output will be correlated with changes in surface charge, wettability, turbulence, and collector adsorption, providing mechanistic insight into reagent effectiveness for microcrystalline graphite flotation.

KEY WORDS

Critical minerals, graphite, flotation

BIOGRAPHY

Jack Walsh is a PhD candidate at the University of Adelaide, where he is researching the recovery of ultrafine graphite for battery anode use. He has site experience at Sibanye Stillwater's Century Operation and BHP Carrapateena. His area of interest is in critical mineral recovery, particulary in the energy- and cost-efficient recovery of textured ores.

CONFERENCE PROGRAM

Please indicate which conference program your abstract relates to:

☐ Hazards Australasia

☒ Chemeca