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Development of Ceramic Spheres Buoyancy Modules for Deep-Sea Oil Exploration

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Abstract : Low-cost ceramic spheres were developed and manufactured from the engineering ceramic aluminium oxide. Hollow spheres of 50 mm diameter with a wall thickness of 0.5-1.0 mm were produced via an adapted slip casting technique. It was possible to produce the spheres with good repeatability and with no defects or failures in the spheres due to the manufacturing process. The spheres were developed specifically for use in buoyancy devices for deep-sea exploration conditions at depths of 3000 m below sea level. The spheres with a 1.0 mm wall thickness exhibit a buoyancy of over 54% while the spheres with a 0.5 mm wall thickness exhibit a buoyancy of over 73%. The mechanical performance of the spheres was confirmed by performing a hydraulic burst pressure test on individual spheres. With a safety factor of 3, all spheres with 1.0 mm wall thickness survived a hydraulic pressure of greater than 150 MPa which is equivalent to a depth of more than 5000 m below sea level. The spheres were then incorporated into a buoyancy module. These hollow aluminium oxide ceramic spheres offer an excellent possibility of deep-sea exploration to depths greater than the currently used technology.

Keywords : buoyancy, ceramic spheres, deep-sea, oil exploration
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