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Nitrogen-Galinstan Two Phase Pumping for MHD Power Generation Systems

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Abstract **–** The continuous demand for energy has open many pathways to develop new sustainable power generation processes. Magnetohydrodynamics (MHD) power generation is an alternative process being investigated to recover energy from low temperature sources but is not limited to low temperatures. Liquid Metal MHD (LMMHD) power generation is the process of circulating liquid metal through an MHD generator using gas injection. The need to design a low energy two-phase gas-lift pump and evaluate its performance as well as the two-phase dynamics in this energy recovering process are crucial components to develop the system. In this study, a preliminary analysis utilizing ANSYS Fluent® for pumping two-phase flow mixture of nitrogen and galinstan is performed. These numerical results along with the analytical model based on drift flux assumptions are used to understand the performance of the gas-lift two-phase flow pump in this system. Reasonable agreement between the numerical and analytical results were obtained. The CFD results were used to describe the void fraction of the two phases in the pipe riser and considered to be the first step to understand the performance of LMMHD power generation loop.

Keywords**:** Two-Phase Flow; Liquid Metal; MHD system; CFD; Gas-lift pump.