

## Characterization of High Phosphorus Gray Iron for the Stub- Anode Connection in the Aluminium Reduction Cells

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**Abstract :** High phosphorus gray iron (HPGI) is used to connect the steel stub of an anode rod to a prebaked anode carbon block in the aluminium reduction cells. In this paper, a complete characterization for HPGI was done, includes studying the chemical composition of the HPGI collar, anodic voltage drop, collar temperature over 30 days anode life cycle, microstructure and mechanical properties. During anode life cycle, the carbon content in HPGI was lowered from 3.73 to 3.38%, and different changes in the anodic voltage drop at the stub- collar-anode connection were recorded. The collar temperature increases over the anode life cycle and reaches to 850°C in four weeks after anode changing. Significant changes in the HPGI microstructure were observed after 3 and 30 days from the anode changing. To simulate the actual operating conditions in the steel stub/collar/carbon anode connection, a bench-scale experimental set-up was designed and used for electrical resistance and resistivity respectively. The results showed the current HPGI properties needed to modify or producing new alloys with excellent electrical and mechanical properties. The steel stub and HPGI thermal expansion were measured and studied. Considerable permanent expansion was observed for the HPGI collar after the completion of the heating-cooling cycle.

**Keywords :** high phosphorus gray iron (HPGI), aluminium reduction cells, anodic voltage drop, microstructure, mechanical and electrical properties

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