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# In-situ TiC-Graphite-Ni hybrid composites innovatively fabricated by pressureless reactive infiltration method

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**Abstract:** TiC-Graphite-Ni hybrid composites integrating high hardness of TiC, lubrication of graphite and good fracture toughness of Ni, present excellent tribological properties. This paper innovatively fabricates in-situ TiC-Graphite-Ni composites by pressureless reactive infiltration method, which is simple, low cost and applicable for composites with large and complex shape. The composition of composites is altered by designing C/Ti molar ratio in preforms. In-situ TiC and graphite homogeneously distribute in metal matrix with clean interface. Results show that the graphite content also affects the formation process of in-situ TiC. As C/Ti molar ratio increases from 1 to 1.5, graphite content in composites increases from 0 to 2.7 wt.%, and TiC particle size reduces from 3.03  $\mu\text{m}$  to 2.58  $\mu\text{m}$ , resulting in the increase of Vickers hardness of composites from 527 to 664 HV2. With addition of TiC and graphite, tribological properties of Ni-based alloy are improved, which becomes more obvious as graphite content increases. The friction coefficient of composite with 2.7 wt.% graphite is 19% lower than that of Ni-based alloy. The main wear mechanism of composites is abrasive wear.

**Keywords:** TiC-Graphite-Ni; reactive infiltration; C/Ti molar ratio; tribological properties

## 1. Introduction

Ni-based self-lubricating composites with high corrosion resistance, excellent electrical and thermal conductivity, good friction and wear properties, can be used as structural materials in automotive, aerospace and chemistry industries [1-4]. Vast researches have been focused on the kind and effect of solid lubricant on the properties of Ni-based composites,

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