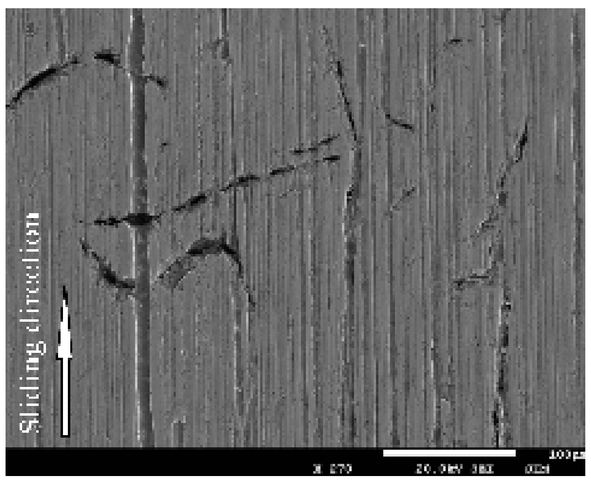
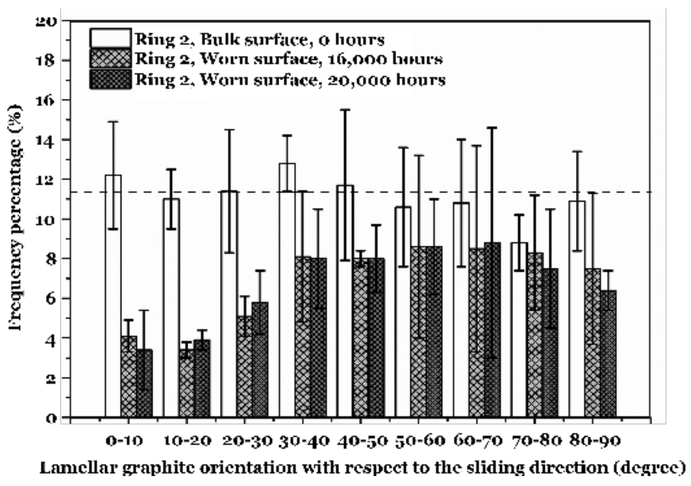
TRIBOLOGICAL AND THERMO-MECHANICAL PROPERTIES OF LAMELLAR GRAPHITE IRON

HELIOS and CastDesign

TRIBOLOGICAL PROPERTIES

As a part of EU-funded HELIOS project, our focus was placed on clarifying the microstructural influence on the tribological properties of lamellar graphite iron (LGI) piston rings used in heavy-fuel marine diesel engines.
Scuffing as one of the main issues was found due to a severe abrasion occurrence in piston assemblies, accompanied by a severe matrix plastic deformation.





GOAL AND INTRODUCTION

The main purpose was to find the potential reasons and improve scuffing resistance of piston rings-cylinder in large-bore marine diesel engines.
LGI has been commonly used in marine diesel engine applications as piston rings and cylinder liners due to the excellent combination of mechanical, physical and tribological properties resulting from the presence of graphite lamellas, which act as solid lubricant agents, which is essential to avoid scuffing and bore polishing issues.

RESULTS

A severe consequences of matrix deformation, caused by abrasion resulted in closure of graphite lamellas those positioned between 0° to 30° relative to the sliding direction. This dramatically resulted in deterioration both the sliding surface texture and self-lubrication performance of piston ring and in the worst-case scenario causes scuffing issue.

INDUSTRIAL IMPACT

The obtained knowledge helps to improve the overall service life of diesel engines and develop new high-tribological performance piston rings and cylinder liner cast irons.

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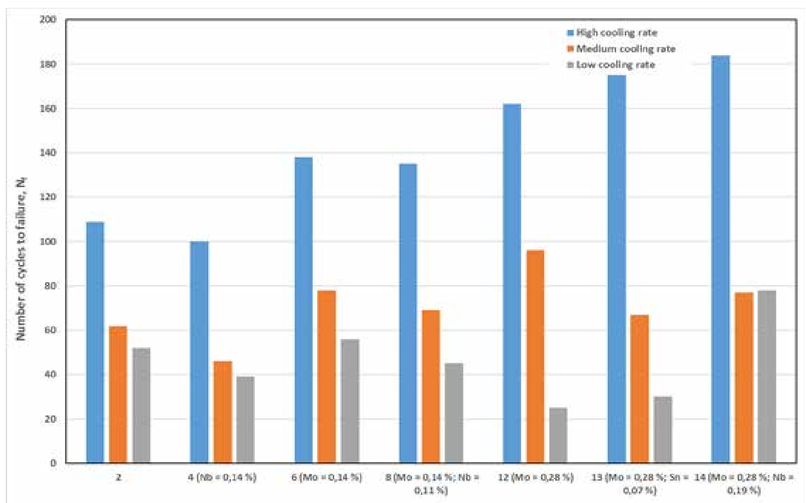
THERMO-MECHANICAL PROPERTIES

The objective of the project is to develop new gray iron and compacted graphite iron alloys with improved thermo-mechanical fatigue properties.



GOAL AND INTRODUCTION

As a part of CastDesign project, the focus was placed on clarifying the effect of alloying elements (Mo, Nb) on the thermo-mechanical fatigue properties of lamellar graphite cast iron.

RESULTS

The combination of molybdenum and niobium was interesting in order to observe the combined effect of molybdenum and niobium onto the thermo-mechanical properties of cast iron. Some correlation between thermo-mechanical fatigue properties and primary austenite dendrites fraction was found for the high cooling rate samples.

INDUSTRIAL IMPACT

The obtained knowledge helps to improve the thermo-mechanical fatigue life of engine cylinder heads, which are most susceptible to thermomechanical fatigue damage and creep due to their proximity to the combustion chamber.

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