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Design and Development of a Pin-on-Disc Tribometer at IFSC Câmpus Criciúma

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Introduction

According to Hutchings and Shipway (2017), tribology studies friction and wear between surfaces in relative motion. Tribometers are essential for measuring friction and wear.

Objectives

To design, build and validate a pin-on-disc tribometer following ASTM G99 (ASTM INTERNATIONAL, 2023).

Methodology

The interlaboratory test with LdTM/UFRGS used a WC-Co Ø 10 mm ball against an AISI H13 (48 HRC) disc, 10 N, 0.2 m/s and 800 m. The tracks were measured by white light interferometry (Figure 1) and the wear rate was obtained as k = V/(F·L) (ARCHARD, 1953).

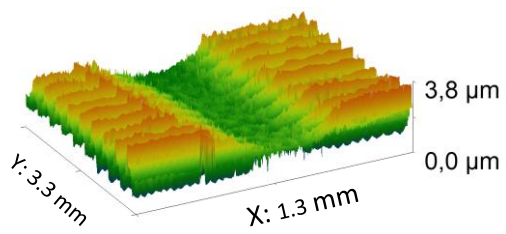


Figure 1. Wear track topography.

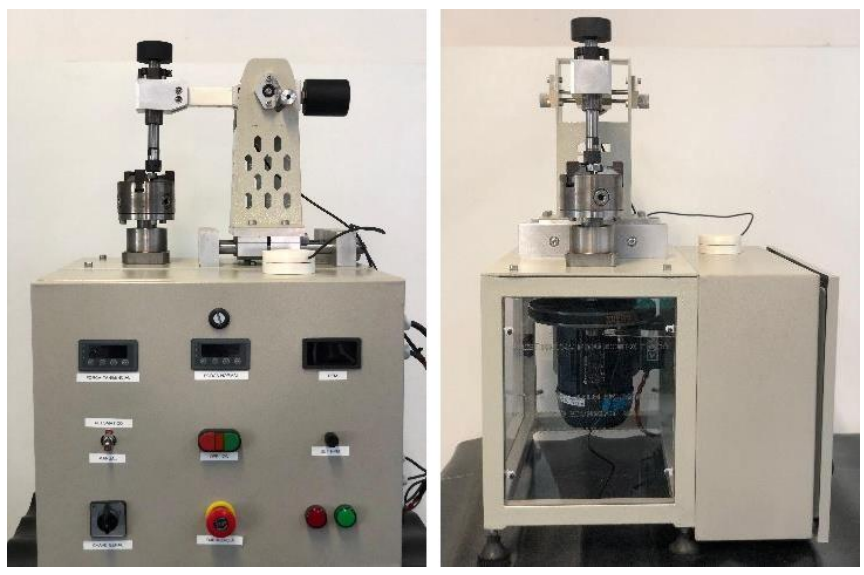


Figure 2. Developed tribometer.

The specific wear rate was **(9.1 ± 1.0) × 10^{-6}** mm³/N·m at IFSC and **(9.8 ± 0.7) × 10^{-6}** mm³/N·m at LdTM/UFRGS, with tracks of similar width and depth on both devices (Figure 3).

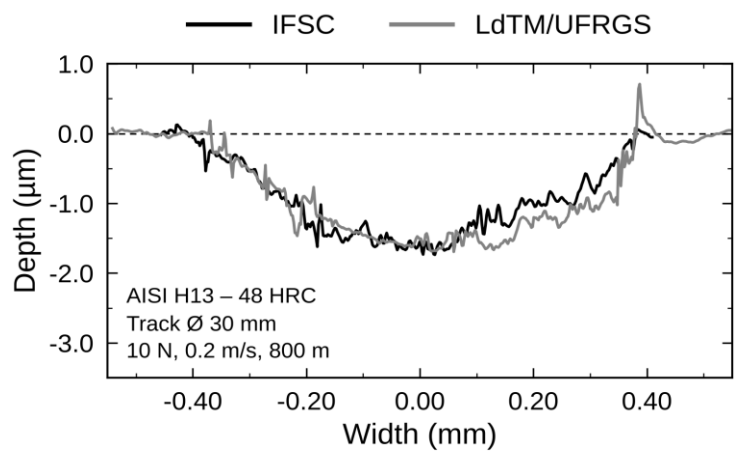


Figure 3. Wear track profiles.

Results and Discussion

The main result of this work is the pin-on-disc tribometer built at IFSC (Figure 2). In the interlaboratory test, the mean coefficient of friction between 700 and 800 m was **0.72 ± 0.02** at IFSC and **0.77 ± 0.03** at LdTM/UFRGS. The difference, of about 6 %, is of the same order as the scatter observed between replicates of the reference device.

Conclusions

The results show that the developed tribometer is a viable alternative for tribological characterization in research and teaching activities in materials science and mechanical engineering, expanding the experimental capacity of the institution and the region.

References and Acknowledgments

ARCHARD, John Frederick. Contact and rubbing of flat surfaces. **Journal of Applied Physics**, v. 24, n. 8, p. 981-988, 1953. DOI: 10.1063/1.1721448.
ASTM INTERNATIONAL. **ASTM G99-23**: standard test method for wear and friction testing with a pin-on-disk or ball-on-disk apparatus. West Conshohocken: ASTM International, 2023.
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Projeto e Desenvolvimento de um Tribômetro Pino sobre Disco no IFSC Câmpus Criciúma

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Introdução

Segundo Hutchings e Shipway (2017), a tribologia estuda o atrito e o desgaste entre superfícies em movimento relativo. Tribômetros são essenciais para medir atrito e desgaste.

Objetivos

Projetar, construir e validar um tribômetro pino sobre disco segundo a norma ASTM G99 (ASTM INTERNATIONAL, 2023).

Metodologia

O ensaio interlaboratorial com o LdTM/UFRGS usou esfera de WC-Co Ø 10 mm contra disco de AISI H13 (48 HRC), 10 N, 0,2 m/s e 800 m. As trilhas foram medidas por interferometria de luz branca (Figura 1) e a taxa de desgaste foi obtida por k = V/(F·L) (ARCHARD, 1953).

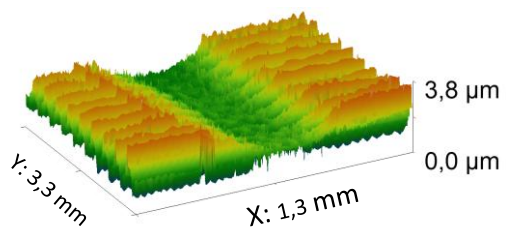


Figura 1. Topografia da trilha.

Resultados e Discussão

O principal resultado deste trabalho é o tribômetro pino sobre disco construído no IFSC (Figura 2). No ensaio interlaboratorial, o coeficiente de atrito médio entre 700 e 800 m foi de **0,72 ± 0,02** no IFSC e de **0,77 ± 0,03** no LdTM/UFRGS. A diferença, de cerca de 6 %, é da mesma ordem da dispersão observada entre as réplicas do equipamento de referência.

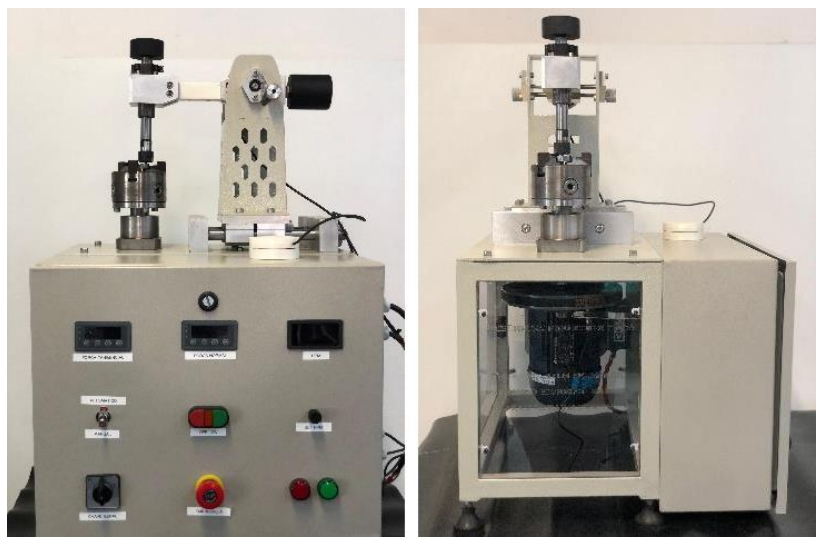


Figura 2. Tribômetro desenvolvido.

A taxa de desgaste específica foi de **(9,1 ± 1,0) × 10⁻⁶** mm³/N·m no IFSC e de **(9,8 ± 0,7) × 10⁻⁶** mm³/N·m no LdTM/UFRGS, com trilhas semelhantes nos dois equipamentos (Figura 3).

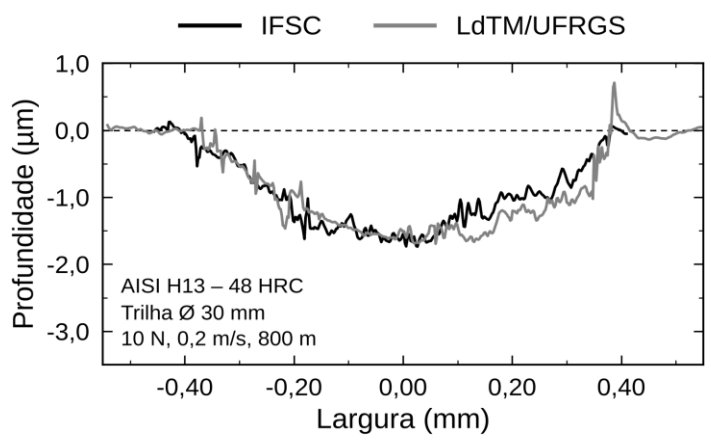


Figura 3. Perfis das trilhas.

Conclusões

Os resultados demonstram que o tribômetro desenvolvido constitui uma alternativa viável para a caracterização tribológica em atividades de pesquisa e ensino nas áreas de ciência dos materiais e engenharia mecânica, ampliando a capacidade experimental da instituição e da região.

Referências e Agradecimentos

ARCHARD, John Frederick. Contact and rubbing of flat surfaces. **Journal of Applied Physics**, v. 24, n. 8, p. 981-988, 1953. DOI: 10.1063/1.1721448.
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