

## Study of the wear mechanisms and solutions regarding inserts used on cork grinders

T. Oliveira<sup>1,2</sup>, F. J. G. Silva<sup>1\*</sup>, R. J. D. Alexandre<sup>3</sup>, A. P. M. Baptista<sup>4</sup>, A. Alves<sup>2</sup>

<sup>1</sup>ISEP – School of Engineering, Polytechnic of Porto  
Rua Dr. António Bernardino de Almeida, 431  
4200-072 Porto, PORTUGAL

<sup>2</sup>AMORIM CORK COMPOSITES, S.A.  
Rua de Meladas, 260  
4535-186 Mozelos, Santa Maria da Feira, PORTUGAL

<sup>3</sup>TEandM – Technology, Engineering and Materials, S.A.  
Parque Industrial do Taveiro, Lotes 41/42  
3045-508 Taveiro, PORTUGAL

<sup>4</sup>INEGI – Instituto de Ciência e Inovação em Eng. Mecânica e Eng. Industrial  
Rua Dr. Roberto Frias, Campus da FEUP  
4200-465 Porto, PORTUGAL

### Abstract

Cork was one of the main pillars in the Portuguese economy some decades ago, being nowadays one of the most important natural materials currently exported from Portugal to the entire world. Initially, wine bottle stoppers were almost exclusively the only product extracted from the cork oak hull. However, the high quality required by the bottle stoppers makes unviable the use of some cork hooves and the waste generated by the bottle stoppers extraction also is considerable. Moreover, the traditional Portuguese creativity allows bringing to the market a huge number of products based on cork aggregates as composites, due to the addition of bonding and other materials in order to improve the overall characteristics of those products. Nowadays, cork composites are used in products as distinct as sportive floors, wall memos, lady bags or shoes.

However, these composites need to be processed and one of the first steps to produce the cork granules is its grinding process. Despite the cork presenting a relatively low mechanical strength and hardness, the grade of abrasion generated by cork on grinder inserts during the grinding process is considerable. Companies devoted to cork composites have as main initial operation the cork wastes sorting, separating eventual metallic pieces coming to the process together with the cork. Posteriorly those wastes are driven to the grinders leading to the granules generation and further particle size selection. The inserts used in these grinders as main tools to proceed to the grinding process are severely affected by wear and the increasing competitiveness imposed by the market is forcing to face this concern with care.

This study intends to realize what kind of wear mechanisms are strongly influencing the premature end-of-life of the grinding inserts, which occurs due to reduced cutting efficiency and generation of out of specification cork granules, allowing to determine the best ways to extend their life cycle, improving the cost/benefit ratio and allowing to get a better equipment performance by the increase of the OEE (Overall Equipment Efficiency) of the machines related to this manufacturing operation. Results obtained led to understand the phenomena induced

in the inserts and some promising alternative solutions using special materials and coatings were drawn and tested, allowing improve the inserts wear behavior thus making this operation more efficient and profitable.

*Keywords:* Cork, Cork grinders, Grinders inserts, Inserts wear, Wear mechanisms, Abrasion, Coatings

(\*) Corresponding Author: F. J. G. Silva, [fgs@isep.ipp.pt](mailto:fgs@isep.ipp.pt), (+351) 228340500