ABSTRACT

Despite the huge quantity of investigations carried out on the wheel-rail contact problem, a lot of questions remains, and the variability of the data found by various authors doesn't help to improve the situation, making harder the finding of behaviour rules and the selection of new materials.

In this Thesis, a new twin-disc testing machine has been employed in order to establish the level of adherence that can be expected in a wide range on normal load and sliding conditions, both in clean and oil or water-contaminated surfaces. At the same time a complete characterization, in the mentioned range of conditions, has been obtained for the consequences of rolling with respect to the test discs wear and the changes they suffer, including plastic deformation and its consequences (hardening and cracking due to exhaustion of plasticity) and other alterations of the surface as their look or roughness.

Having a big quantity of results has allowed the identification of empirical relationships between the control variables of the tests (normal load and sliding) and adhesion, the wear rate and the other results obtained from the various contact conditions (surface clean, with water or with oil) so that you have a clear view of the influence of the control variables on the transmission of stresses in rolling, wear and changes which occur on the surface of the materials in contact.

In the study both plain carbon steels and steels with a bainitic hardening treatment have been used. This has allowed the study of the advantages and disadvantages of each material and see how bainitic steels provide a similar level of adhesion but with a worse response to wear, not being, in principle, a viable alternative to current rail steels.