Experimental Procedure high stress abrasive wear testing

(Step by Step)

- Collect your sample and keep it in a cover by marking your group no. and date
- Polish one face of the the sample as explained in the experimental procedure upto 800 grit emery paper. Clean other faces/edges to remove rust.
- Take initial dimensions and initial weight (W_1) after cleaning the sample and record the readings in laboratory copy (mandatory for all).
- Mount abrasive paper of 220 grade on the Al wheel as described.
- Fix the sample in the instrument as explained and fix all other parameters (load and test duration).
- Run the instrument and record and keep an eye on the time spent on experiment (needed in case of power failure).
- Remove the sample; take final weight, W_2 (after cleaning) after completion of the test.
- Data analysis and report preparation as described and discussed.

TRIBOLOGICAL STUDY OF DIFFERENT MATERIALS

Study of high stress abrasive wear behaviour

Theory

Abrasive wear occurs when a hard rough surface slides across a softer surface. ASTM International (formerly American Society for Testing and Materials) defines it as the loss of material due to hard particles or hard protuberances that are forced against and move along a solid surface. Abrasive wear is commonly classified according to the type of contact and the contact environment. The type of contact determines the mode of abrasive wear. The two modes of abrasive wear are known as two-body and three-body abrasive wear. Two-body wear occurs when the grits or hard particles remove material from the opposite surface. The common analogy is that of material being removed or displaced by a cutting or ploughing operation. Three-body wear occurs when the particles are not constrained, and are free to roll and slide down a surface. The contact environment determines whether the wear is classified as open or closed. An open contact environment occurs when the surfaces are sufficiently displaced to be independent of one another. There are a number of factors which influence abrasive wear and hence the manner of material removal. Several different mechanisms have been proposed to describe the manner in which the material is removed. Three commonly identified mechanisms of abrasive wear are: (a) Ploughing, (b) Cutting and (c) Fragmentation. Ploughing occurs when material is displaced to the side, away from the wear particles, resulting in the formation of grooves that do not involve direct material removal. The displaced material forms ridges adjacent to grooves, which may be removed by subsequent passage of abrasive particles. Cutting occurs when material is separated from the surface in the form of primary debris, or microchips, with little or no material displaced to the sides of the grooves. This mechanism closely resembles conventional machining. Fragmentation occurs when material is separated from a surface by a cutting process and the indenting abrasive causes localized fracture of the wear material. These cracks then freely propagate locally around the wear groove, resulting in additional material removal by spalling.

Experimental Procedure:

High-stress (two-body) wear tests are performed on metallographically polished rectangular specimens (size: 50 mm x 35 mm x 4 mm) using a DUCOM TR – 605 abrasion tester. Emery papers of different grades (220 (68 μm) or 600 (26 μm) or any other grades) are used to press the samples against the abrasive medium with the help of a cantilever loading mechanism. The specimens experience to-and-fro motion against the abrasive particles while the abrasive wheel also changes its position by the time the specimen has completed one cycle (corresponding to a sliding distance of 0.0625 m). This enables the samples to encounter fresh abrasive particles (in each cycle) prior to traversing 400 cycles (corresponding to a sliding distance of 25 m). Beyond this distance, the prior degraded abrasive paper is used to abrade the pre-worn surfaces (i.e. on the same wear track of the samples). Abrasive wear tests are conducted for different number of cycles like, 400, 800, 1200, 1600, 2000 and 2400 cycles corresponding to sliding distances of 25, 50, 75, 100, 125 and 150 m respectively. A fixed rpm of 40 was maintained in each test. The tests are performed with varying applied loads for different grades (220, 600 etc.) of emery paper. The specimens are cleaned in acetone prior to and after the wear tests and weighed using a Sartorius microbalance, with ±0.01 mg accuracy. The wear rate (volume loss / sliding distance) is been calculated from the weight loss measurement by dividing the weight loss with density of the sample and corresponding sliding distance. Wear resistance is reciprocal of wear rate.

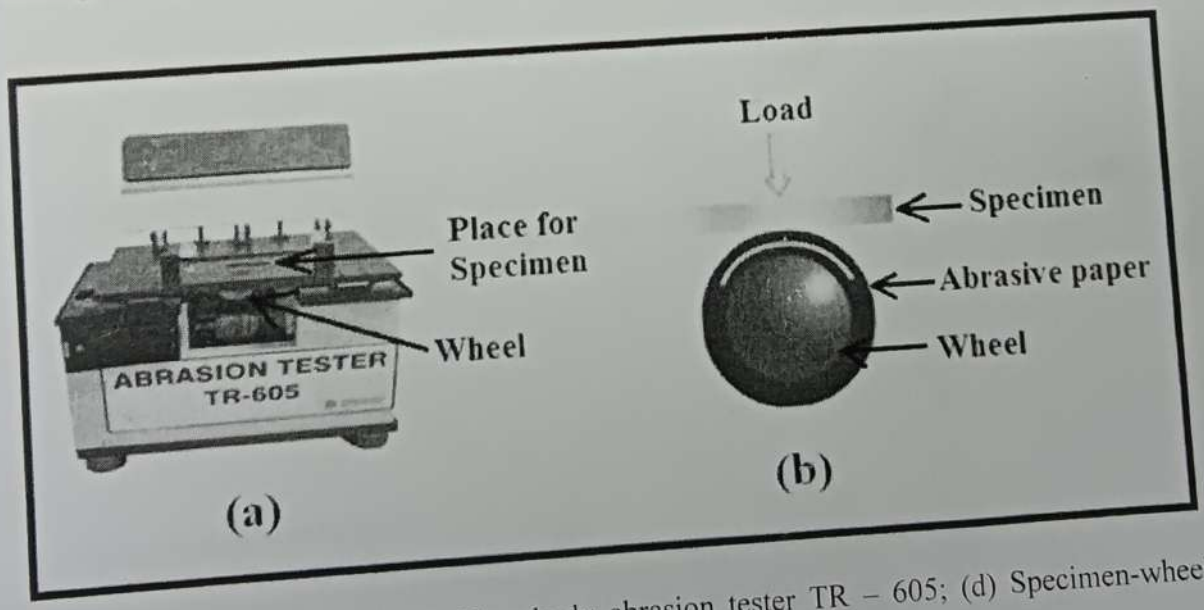

Fig.1: Wear test apparatus: (a) Two body abrasion tester TR – 605; (d) Specimen-wheel contact.

Results:

REPORT THE FOLLOWINGS:

PLEASE MAKE REPORT INDIVIDUALLY (REFRAIN FROM COPYING)

You may take help of computer for plotting at the end (to combine results of Experiment 4-6) only but insert (by typing)

(a) Name,

(b) Roll number

(c) Group number

(d) Experiment number and

(e) Date on it

(XEROX PLOTS ARE NOT ALLOWED)

Individually for each sliding distance

(a) Calculate weight loss and wear rate as explained and discussed

After completion of Experiment 4-6

(a) Plot weight loss Vs. sliding distance graph for different sliding distances

(b) Plot wear rate vs. sliding distance graph for different sliding distances

Discussion:

Explain the individual (for each experiment) and final plots (after completion of Experiment 4-6).

Conclusion/summary:

Include for each experiment and after completion of Experiment 4-6.