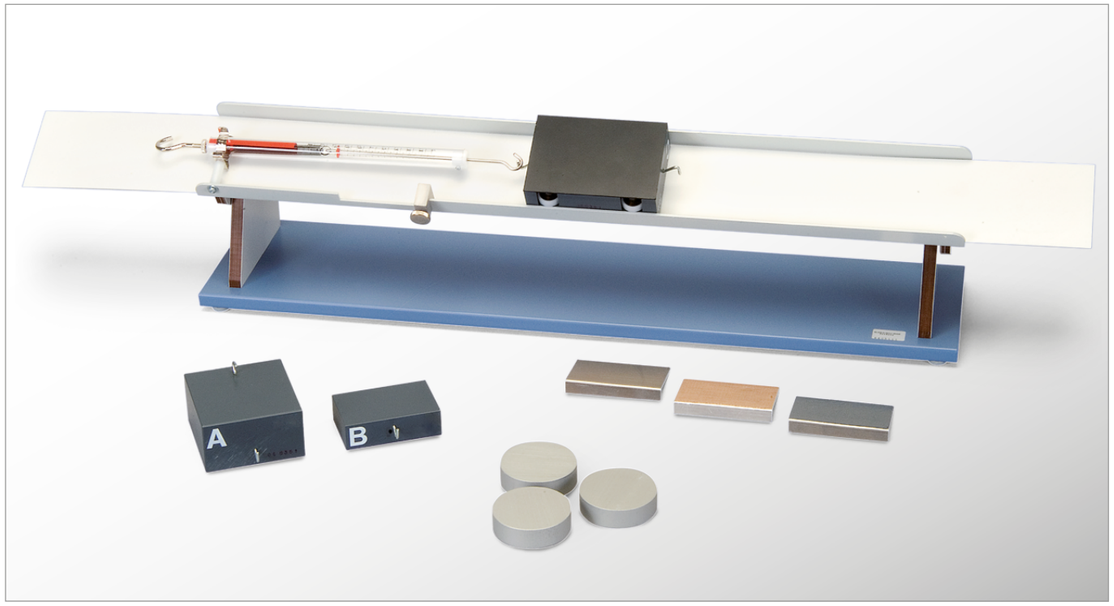
UE1020500 I STATIC AND DYNAMIC FRICTION



› EXPERIMENT PROCEDURE

- Comparison of static and dynamic friction.
- Measurement of how dynamic friction depends on the area in contact.
- Measurement of how dynamic friction depends on the combination of materials.
- Measurement of how dynamic friction depends on the perpendicular force between the two surfaces (normal force).

OBJECTIVE

Measurement of friction forces

SUMMARY

In order to measure dynamic friction, a friction measuring apparatus is used. It is composed of movable friction strips, which are pulled from under a stationary rough body connected to a dynamometer at constant speed. In order to vary the effective weight (and therefore the normal force) of the stationary body, the angle of the track can be set to any angle.

REQUIRED APPARATUS

Quantity	Description	Item Number
1	Friction Measuring Apparatus	1009942

BASIC PRINCIPLES

In order to move an object from rest along a level surface, a force of inertia needs to be overcome. This results from static friction between the body and the surface on which it rests. If, once moving the body is to continue sliding along the surface, a force of F_{Dyn} needs to be applied to overcome the dynamic friction. This force is smaller than the initial force needed to overcome the inertia caused by static friction F_{Stat}, as the degree of contact between the sliding body and the surface beneath is less.

Neither of these forces are dependent on the area in contact, instead being determined primarily by the types of materials and the roughness of the surfaces in contact. They are also proportional to the force that is pushing the surfaces together in a plane perpendicular to that of the surfaces themselves. This is called the normal force F_N (it acts normally, i.e. perpendicular to the surface). The coefficients of static friction μ_{Stat} and dynamic friction μ_{Dyn} are thereby defined as in the following two equations:

(1) $$F_{Stat} = \mu_{Stat} \cdot F_N \quad \text{and} \quad F_{Dyn} = \mu_{Dyn} \cdot F_N$$

In order to measure dynamic friction, an apparatus for measuring such friction is used, in which rough strips are pulled out at constant speed from under a body that remains stationary and is also connected to a dynamometer. Measurements are made for various combinations of materials and contact areas. To alter the normal force the track can be tipped up so that the component of the stationary body's weight that acts normally to the plane of the surface changes.

EVALUATION

If the track is tilted by an angle α, the normal force exerted by a body of mass m in the direction perpendicular to the inclined plane is as follows:

$$F_N = m \cdot g \cdot \cos \alpha$$

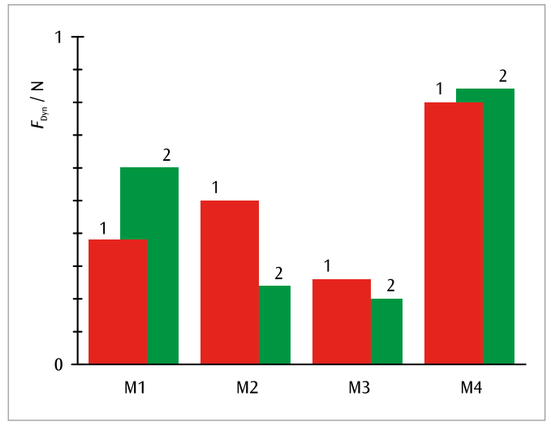


Fig. 1: Dynamic friction F_{Dyn} for four different materials on a smooth surface (1) and a rough surface (2)

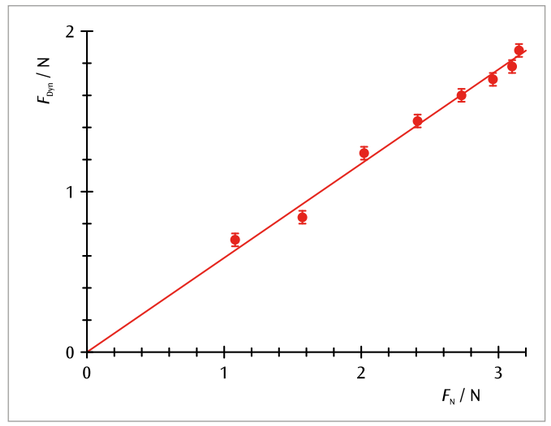


Fig. 2: Dynamic friction F_{Dyn} depending on normal force between the two surfaces F_N