Electric Coefficient of Friction Experiment

Purpose

Measure the coefficient of static friction of two objects' contact areas. When an object slides on the surface of different materials with same contact area, we can observe the change of the object's static and kineic friction. Compare the static friction of different materials.

Theory

Static friction: If an object remains still, the static friction equals to the pulling force. The greater the pulling force, the greater the static friction. However, static friction has its limitation. When the object is about to move by the pulling force, the static friction reaches its maximum. This is called the maximum force of static friction. When the object moves, the friction which acts on the contact areas is force of kineic friction, as shown in **Figure 1**. In order to acquire accurate friction coefficient, the object is placed on a plane and the experiment is operated by motors instead of manual so we can avoid errors by manual operation.

The maximum force of static friction and the force of kineic friction are directly proportional to the normal force N (the perpendicular force of two contact planes). Their relationship can be expressed as

$$f_s = \mu_s \times N \quad \text{and} \quad f_k = \mu_k \times N$$

μ_s：Coefficient of static friction　　μ_k ： Force of kineic friction

N： Perpendicular force of two contact planes

If we know the material of contact plane, μ_k is always smaller than μ_s . The values of μ_k and μ_s are determined by the material of contact areas.

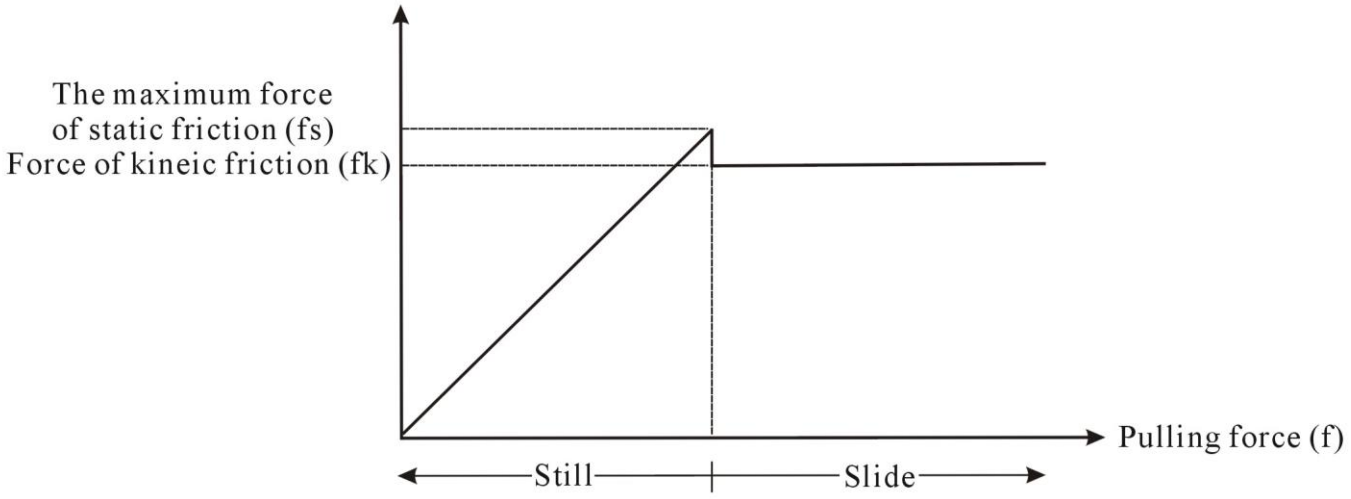
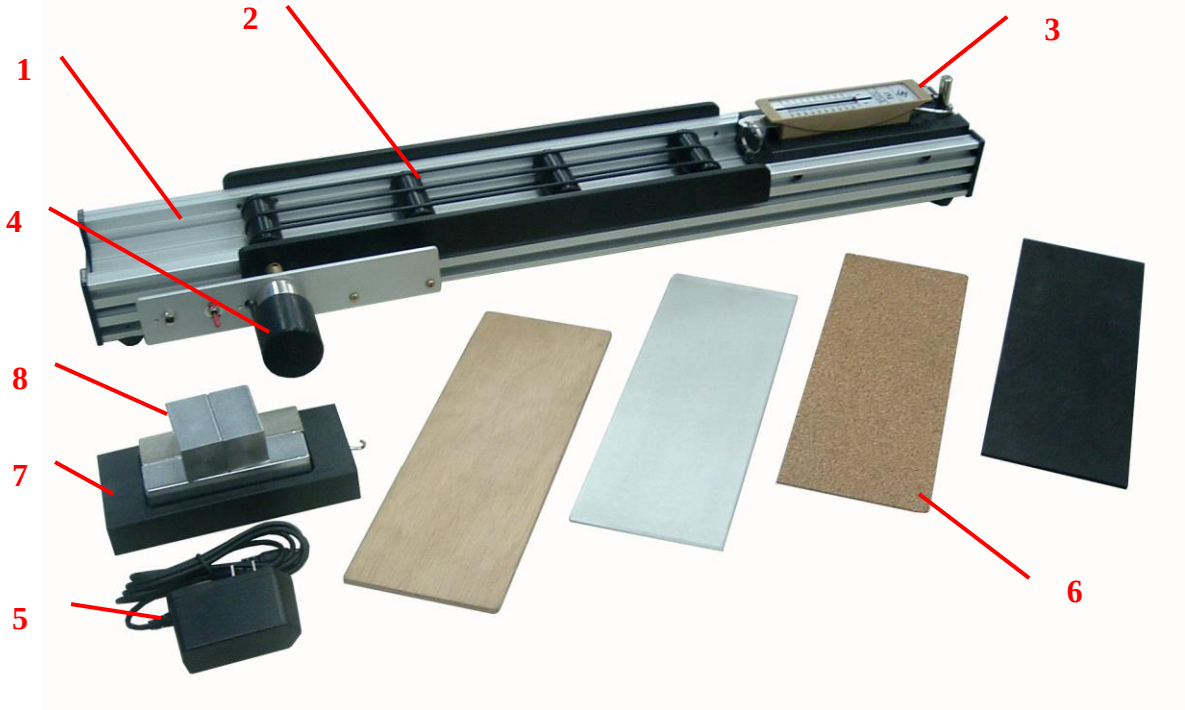


Figure 1 The change of friction of an object moving from still

Instruments

No.	Accessory	Qty.	No.	Accessory	Qty.
1	Experimental base	1	**2**	Pulley transmission belt and base	1
3	Spring balance (1KG) and its base	1	**4**	Power transmission device	1
5	Power supply	1	**6**	Friction plane	4
7	Friction loading box	1	**8**	Strip-shaped weight (500g×2、250g×2)	4



Procedure

1. Please the spring balance on the base. Put inelastic rope on the hook. Connect the hook to the hook on the friction loading box.
2. Connect the power supply to the experimental base to examine whether the power transmission device can drive pulley transmission belt.
3. Measure and record the total weight (N) of loading box with mass.
4. Put the friction plane on the belt. Put the loading box with mass on the friction plane.
5. Turn on the power so the belt starts to pull the plane. When the spring balance is pulled to the maximum force of static friction, observe and record the value. The value we obtain is the maximum force of static friction.
6. Record where the spring pointer stops. It is the force of kineic friction.
7. Change the total weight of loading box. Measure the maximum force static friction under different weight. Observe if the value is a fixed constant after calculation. The fixed constant is the friction coefficient of the friction plane and the loading box.
8. Change the friction plane and repeat procedure 3~6.

Notice:

1. Clean the friction planes before the experiment
2. The rope connecting the loading box and the spring should be short.
3. Repeat the experiment several times when measuring the maximum force of static friction. Eliminate unexpected values to calculate the average value.
4. Press the loading box before turning on the motor so the motor can adhere tightly to the plane. To get more accurate data, hang the rope but do not pull it tight.

Experiment data

Friction plane	Weight of pan and mass (gw)	Maximum force of static friction f_s (gw)	Normal force	Coefficient of Friction
Wooden plane				
			Average	

Friction plane	Weight of pan and mass (gw)	Maximum force of static friction f_s (gw)	Normal force	Coefficient of Friction
Foam plane				
			Average	

Friction plane	Weight of pan and mass (gw)	Maximum force of static friction f_s (gw)	Normal force	Coefficient of Friction
Acrylic plane				
			Average	

Friction plane	Weight of pan and mass (gw)	Maximum force of static friction f_s (gw)	Normal force	Coefficient of Friction
Cork plane				
			Average	

Questions and discussion

1. Explain why the maximum force of static friction is greater than the coefficient of force of kineic friction?

2. If the friction coefficient is greater than 1, is it reasonable?

Atis Scientific Instruments Co.,Ltd
Address：1F., No.18, Nanming St., South Dist.,
Tainan City 702, Taiwan (R.O.C.)
E-mail:atis@atissi.com.tw
Tel: (886) -6-2925201
Fax: (886)-6- 2611476
Mobile:+886-9-8006-1128
Website: www.atis.com.tw

All rights reserved