Smart Materials: Old times, fire lamps

While prehistoric men initially might have had to wait for a lightning strike to ignite a fire, they soon learned that “flash rocks” enabled them to have fire on demand. These are very cool materials that spark upon impact, and in today’s world they are known as piezoelectric materials. While this may be a very scary word to use in a middle school classroom, the fact that we still use them in lighters may bring some attention.

Unfortunately, flash rocks typically only emit a small spark that can be seen only if it is dark. On the other hand, an oil lamp can show how men managed to carry light around. While fire is mostly a chemical reaction, the cotton wicks of oil lamps are actually interesting materials that use microcapillarity concepts. Explaining the sorts of fibers that can be used as wicks is an interesting way to introduce porous materials.

You will need two oil lamps that can be as simple as a can with a hole on the top and a wick inserted through the hole. In one of the cans, use a regular cotton wick. It will produce a large flame when ignited. Pass around an extra piece of cotton wick. In the other lamp, use a polyester wick (cord) of the same dimensions. You should see a smaller flame, as the top of it will melt rather than burn as the cotton wick does. Pass around a sample of the polyester wick.

You can contrast the natural and the artificial (man-made) materials. In addition, you can also light a lamp with a thicker polyester fiber cord. This will have even less capillarity than the small polyester wick and reinforce the importance of fiber design.

What do they learn? Materials can be natural or artificial, and materials engineers work with both. Man is inspired by nature to create new materials (cite other interesting examples, such as swimming clothing inspired by dolphin skin). Capillarity can be controlled by using designed fibers and microporosity.

What do you need?

Metal cans, oil lamp fluid (kerosene), matches, cotton wicks, polyester cords with two thicknesses of fibers.