

## WHAT YOU SEE MAY NOT BE WHAT YOU GET

*Diamonds are beautiful to wear and a good investment for your money! But make sure that you know what you are getting.*

Advertisements certainly make it clear that diamonds are valuable. However, in today's world, whenever something has great value, there may be unscrupulous people creating counterfeit versions to sell you. Diamonds are no exception.

There are several substances that are used to create counterfeit diamonds. These range from colourless glass to white sapphire, quartz, moissanite, and, commonly, cubic zirconia. Fake diamonds are called *simulants* (Figure 1).



**Figure 1** Can you tell which is the diamond?

The majority of diamonds in the world are industrial diamonds, such as those used for drill bits (Figure 2). But when people think of diamonds, they think of sparkle and romance. In jewellers' terms, sparkle is actually composed of "brilliance" and "fire," which both arise from the same physical property, called the index of refraction, (or refractive index). Refraction is the changing of the direction of light as it passes from one substance to another. The index of refraction is an indicator of how much the light changes direction. The index of refraction is very high in diamonds, causing the light to split into colours as it reflects off the inner faces until it reaches your eyes. Counterfeit gems also have high refractive indexes. Since the refraction index is a physical property, however, a gemologist (an expert in the study of gems such as diamonds) can measure it and identify the substance. Table 1 shows the refractive indexes of some clear substances. You can see that diamond has the highest index of those listed.

**Table 1** Refractive Indexes of Some Clear Substances

Substance	Refractive index
air	1.00
water	1.33
glass	1.52
dense crystal	1.66
garnet	1.89
cubic zirconia	2.19
diamond	2.42



**Figure 2** Many drill bits used by dentists have a diamond coating.

It does not take a gemologist to identify the fakes though. The police use the physical property of hardness to test for fakes. The hardness of diamonds is well known. Although the hardness of some of the fakes is high (cubic zirconia 8.5, moissanite 9.25, and glass 5.5), their hardness cannot compare with diamond's hardness (10) and they can be quickly identified. A softer substance cannot scratch a harder substance.

Gemologists and the police are also able to identify fake diamonds by determining density. For example the density of glass is  $2.58 \text{ g/cm}^3$ ; moissanite  $3.21 \text{ g/cm}^3$ ; and cubic zirconia  $5.8 \text{ g/cm}^3$ . The density of a pure diamond is  $3.52 \text{ g/cm}^3$ .

So what does this tell you? Fake diamonds have the appearance of real diamonds, but they do not share the same physical properties. Synthetic cubic zirconia is the most popular imitation diamond in today's market. With the unaided eye, a well-cut and polished cubic zirconia is practically impossible to distinguish from a real diamond. With the use of a few scientific procedures, however, it is not difficult to tell a real diamond from the relatively inexpensive fakes.