the oil analysis results indicate. Remember that a given type of metal may be used in several different areas of an engine and oil system. Knowing operational information helps the analyst interpret the data.

Two-way communication with the analyst is crucial. For instance, if the analyst makes a recommendation to look at a specific part based on the results and it turns out nothing is wrong with that part, there is still a problem somewhere! Call the analyst and explain that you followed the recommendations and nothing seemed out of the ordinary. There will then be a review of the data, and based on that information, further recommendations will be made.

Most labs run two types of oil analysis tests on a given sample. They are a spectrometric test and a physical property test. A spectrometric test is one in which the sample is subjected to an extremely high-voltage electrical energy that causes the elements in the oil to give off signature colors and brightness. By understanding these signatures, analysts can interpret how much of a given element, typically reported in parts per million, is in the sample. Analysts also know that specific metals are used to manufacture specific engine parts, an abbreviated version of which is in Table 5-1. For instance, copper is used in wrist-pin bushings and cam bushings, so determination of the origin of the metal contaminant is often possible.

The physical property test checks for such things as the presence of water, fuel dilution, oxidation, and viscosity, which is the measure of a lubricant's resistance to flow. Viscosity increases with time in service due to such things as oxidation, picking up contaminants in the oil, overheating of the oil, improper air/fuel ratio, and an excessive increase in solid materials trapped in the oil. It is also possible for there to be a decrease in oil viscosity due to a bad fuel-injector tip causing fuel dilution of the oil.

The physical properties test will also check for total solids. A sample of the oil is diluted with a solvent then spun in a centrifuge, causing the larger solids to settle, which then makes them easily and accurately measurable. One of the results of this portion of the test is the discovery of carbon particles indicating that there has been an incomplete burning of the fuel, which is a good indicator of the engine's combustion efficiency.

When drawing the oil sample you want to make sure the oil is hot. There are two locations from which you can draw a sample: the dipstick port and the engine sump. You would draw a sample from the dipstick port when you suspect a problem and will be doing tests more frequently than scheduled oil changes. The more common location would be the oil sump during an oil change.

There are many benefits to engine oil analysis. For instance, it should play a major role in breaking in new or recently overhauled engines. Much of an engine's break-in actually occurs during the first hour. The trace amount of copper, chrome, aluminum, and iron reflect how the break-in went and whether or not the engine is likely to make it to TBO. When breaking in either a new or overhauled engine, the oil should be changed frequently. There is a high wear rate during the break-in period, and metal particles can imbed in bearings and severely shorten the engine's life. Typically, oil should be changed at 5 hours, or after the first flight, then again at 10–12 hours, and again at approximately 25 hours. It is a good idea to obtain oil samples at each change, plus at the 60-hour point. If you are using synthetic oil, the 10-hour analysis will show significantly lower levels of