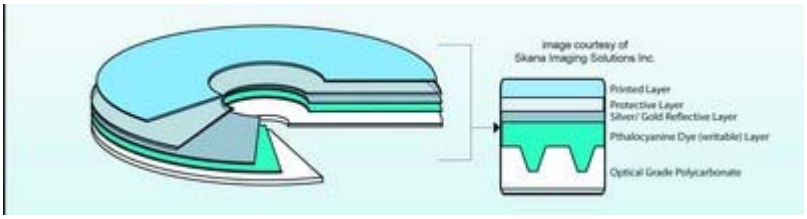
PHOTO MARKETING PMA magazine

Not all CDRs are created equal

By Ron Kubara, Business Development Manager, Noritsu Canada Ltd.

Ron Kubara
Image permanence for CDRs (Compact Disc Recordable) is an area that is not well known or understood by the general consumer, nor by many photo labs. Contrary to popular belief, most CDRs are not permanent, and low-priced CDRs may not be readable at all and error in as little as two years.

A cheap CDR is great for moving files from one PC to another, but risky if being used to archive files or images. Quality CDRs utilize high-quality recording and reflective layers, and are well sealed to reduce the harmful effects of the human environment.



The material used for the plastic substrate (polycarbonate) of the CD and CDR is also important, as it needs to be gas impermeable. Unfortunately, no plastic is; but some plastics are better than others. Even more important is the quality and thickness of the top coatings used to seal layers coated on the substrate.

Prerecorded CDs are made by “stamping” the information into the plastic substrate, then an aluminum alloy coating is applied to the “bumpy” stamped surface. The laser either reflects off this reflective layer and a “1 bit” is determined, or the laser is deflected by the “stamped” bump and a “0 bit” is determined. Contrary to popular belief, the recorded layer of a CD/CDR is not “sandwiched” within the plastic substrate. A clear lacquer protective layer is put on top of the aluminum reflective layer. A label is put on top, or a thick ink coating is applied. As the CD is read from the plastic side, a paper, plastic or ink label applied to the CD provides extra protection against the data surfaces being scratched.

CDRs are not stamped with the data; they are burned with data by the end user. The plastic polycarbonate, however, is stamped with splines (tracks or lines) for the laser to follow. A recording layer is also referred to as the dye layer, and it is sprayed on top of these splines. Four basic chemical formulae are used for the recording layer dye:

1. Cyanine/light green/blue in color: low cost to make, most common and lowest permanence.
2. Phthalocyanine/transparent with a slight green tint: highest permanence and second most common.
3. Metallized Azo/blue: similar in quality to Phthalocyanine, costs less to make and are not common.
4. Formazan/light green: combination of Cyanine and Phthalocyanine, similar in quality to Phthalocyanine, costs less to make, and are not as common.

CDR manufacturers may modify one of these dyes and create a custom, proprietary formula and/or change the traditional color of the dye. Thus, CDR color cannot accurately be used to determine the type of dye used.

CD read lasers are infrared and are not affected by the color or visible light opacity of the dye. As a result, the recording layer dye color is irrelevant to the laser, as it will effortlessly pass through any dye that is not infrared opaque. The dye will become infrared opaque when burned by the write laser.
“Funky” CDRs have a colored dye layer in front of the recording layer dye, creating colored CDRs. Black CDRs block visible light from reaching the recording and reflective layer; thus, these layers cannot be seen by the eye. Yet, the type of black dye used will let the infrared laser pass.

Gamers and music experts believe black CDRs produce better quality CDRs, but this researcher could not find any scientific evidence to support this claim. As a black layer prevents visible light from reaching the recording layer dye (these dyes will fade over time when exposed to visible light), a black layer may increase longevity over an identical grade CDR when both are stored in the light.

A reflective coating made of silver alloy, pure silver, or pure gold is layered on top of the recording layer. Although silver will show the true color of the recording layer dye, gold will change the dye color because of its yellowish color. The burning laser melts a “pit” into the dye, which then blocks the read laser from reflecting back, and a “0 bit” is determined. A good dye burns a nice clean pit, so the read laser knows for sure if it is a “0 bit” or “1 bit.” If the burn is not clean and the edge is not a clean cut, the CDR will produce an error.

To protect the coatings, lacquer is applied, and high-quality manufacturers make it nice and thick or will even apply a separate protective coating. Poor CDRs have very little protection on the coatings and will scratch easily, or worse, delaminate. By writing with a nonwater-base felt pen, the ink could make its way to the data layer and damage a poorly sealed CDR. But be aware that even the best-coated CDRs can be damaged over time by nonwater-based felt markers.

It is difficult to use CDR color only as a guide; but as a general guideline, if the CDR does not have a color tint, it is likely a lower-quality silver alloy with a poor dye layer. Blue, green, and faint green CDRs will be good if they used quality silver. Unfortunately, there is no way to know for sure. Gold CDRs are the best because, when the manufacturers use gold, they use a quality dye. But don’t be fooled by manufacturers that place a gold-color label on the non-read side, or the ones that add a funky gold-color layer on the read side.

There are several reasons for good or poor CDR permanence.

1. Plastic (polycarbonate substrate) is oxygen permeable. Oxygen eventually makes its way through the non-lacquered side (as well as the lacquered side in some cases) and reaches the reflective layer. As aluminum corrodes when exposed to oxygen, and silver corrodes or tarnishes when exposed to sulfides in air, air reaching the reflective layers will cause corrosion, causing a read error. This could happen in as little as two years with poor CDs. Gold CDRs are best in this area, followed by gold/silver alloy. Silver/aluminum alloy is the poorest.
   Equally important is the optical quality of the plastic. High optical-quality CDRs permit the light to pass through the polycarbonate with little or no diffusion, permitting a cleaner burn to the dye. The spiral grooves stamped to the CDR vary by manufacturer. It is easier and cheaper to make a V-shaped groove than a sharp edge U groove. A V-type stamp will have a higher degree of skipping errors, as the laser may not be able to track properly, much like the needle of a phonograph if it does not have enough weight on it. Additionally, the stamp will wear as it stamps CDR after CDR, resulting in a U-shaped groove becoming more V-shaped over time, which may lead to skipping and errors.
2. The dyes used in the recording layer are light sensitive, and will react to ambient light and fade over time. Quality CDRs use a dye that resists fading. To be safe, store them in the dark.
3. Humidity may seep through a poor lacquer coating. Quality CDRs are well sealed and resist seepage from markers and moisture. To make them last, store in low humidity, and use water-based markers and write on the center core.
4. A scratch on the base side can be repaired, but a scratch on the lacquer side makes the CD a coffee table coaster. Quality CDRs have a thick, protective coating to resist scratches.

Archiving reports vary by manufacturer, but 70 years would be low for a quality CDR, with the norm being 100 years. Some manufacturers of gold CDRs claim 100 to 200 years. You generally get what you pay for. Don’t put those precious images on a CDR that costs just a few nickels and dimes.

The opinions expressed in this column are not necessarily those of Photo Marketing *magazine or Photo Marketing Association International.*