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THE SMALL CORPORATION

19 Butternut St, Greenfield, MA 01301
800-392-9500 413-772-0889 Fax 413-773-7386
www.smallcorp.com

Silica gel is a granular, vitreous, porous form of silicon dioxide made from sodium silicate. It is a naturally-occurring mineral that is purified and processed into a granular or beaded form. It is frequently used in commercial and household applications, typically for water absorption.

It is also a common and very effective tool to maintain stable relative humidity in a sealed exhibit case. The material is very porous and the surface area of the internal pores is extremely high, in the range of several hundred square meters per gram. Water molecules are readily adsorbed onto these interior surfaces. The effect is that the silica gel is a sponge, ready to accept water and release water.

For museum applications, silica gel can be conditioned to a specific relative humidity by allowing dry gel to adsorb a specific amount of water. Once conditioned, the gel will “try” to maintain the specific relative humidity associated with that percentage of water content. Drier air infiltrating the case will cause the air in the case (and the gel) to gradually dry out, and the introduction of more humid air will cause the gel and the interior environment to gradually become more moist. The gel will act as a buffer to slow down the changes in the case by giving up or taking on water. A case that is better sealed and has more silica gel will have a more stable relative humidity.

In the real world, silica gel cannot maintain an absolutely stable relative humidity in a case that’s in an unstable environment. However, stability within a few percentage points is readily achievable. The factors affecting how much gel to use are:

1. How well-sealed the case is, i.e., what its air exchange rate is
2. How often you are willing or able to change or recondition the gel
3. How far away from your target humidity you’re willing to go
4. How far from your target humidity the gallery is

Numbers two and three are a matter of personal choice. Number four can be measured or fairly easily guessed at. Number one is the hardest to figure out.

Exhibit cases can range from several air exchanges per day to nearly hermetically-sealed. With a little effort, most cases can be brought into the range of two exchanges per day. A well-designed and fabricated case can be brought under 0.1 air exchange per day. Achieving air exchange rates less than 0.1 per day requires great care and sophistication of design. It is important to remember - when using a well-sealed case always take care that the materials in the case are suitable and will not harm the objects.

The following types of silica gel, or modified silica gel products, are commonly used in museums. Each has characteristics that make it most-suitable for specific conditions.

1. Type E silica gel works well in the 0-30% RH range
2. Type A silica gel works well in the 0-60% range
3. Art Sorb (which contains both silicon dioxide and lithium chloride) works well above 60% RH.

Many products sold as “desiccants” are good for drying things out, but not good for maintaining a microclimate. Type A silica gel is the most versatile product for microclimates at typical museum humidity requirements.

Typically, silica gel will have to be reconditioned from time to time by either drying it out or adding moisture to it. This is especially true when objects in the case require an RH that is markedly different from the gallery average, when putting enough gel into the case isn't practical, or when the case is too leaky. Simple equipment is available for conditioning silica gel. If the yearly average humidity in the gallery is acceptable for the objects, it is often possible to put enough silica gel into a case such that no maintenance is required. In such a situation, the gel can buffer the daily and seasonal variations enough to keep the objects within an acceptable range.

Care should be taken in placing the gel media to ensure that the surface of the silica gel has enough exposure to the case environment. There should be ample air circulation between the area where the gel is and the air surrounding the objects. Gel hidden in risers near the objects will be particularly effective. Gel under the case deck will require a gap around the edge of the deck of at least 3/8” for air circulation. If the gel is in a thick mass, the gel that is not near the surface will be very slow to react. A maximum of one inch of thickness is a good guideline.

Silica gel, whether conditioned to a specific RH or not, should be stored in sealed, archival containers. Otherwise, it will gradually take on the RH of the surrounding environment. If you choose not to recondition your silica gel, and assuming it has not come into contact with any hazardous chemicals, it can be thrown away in the garbage without any special handling.

General microclimate guidelines:

- Use the right gel for your RH requirement. Type A is the most versatile.
- Don't skimp on the quantity of gel. More is always better.
- Don't place the gel in too thick a mass. The more exposed surface area the better. A maximum of one inch of thickness is a good guideline.
- Allow for air circulation between the gel and the objects. Gel located in the actual exhibit area is best.
- Monitor the humidity in the case with a hygrometer or an indicator strip.
- If your case is very well-sealed, make sure that there are no materials in the case environment that will harm the objects.