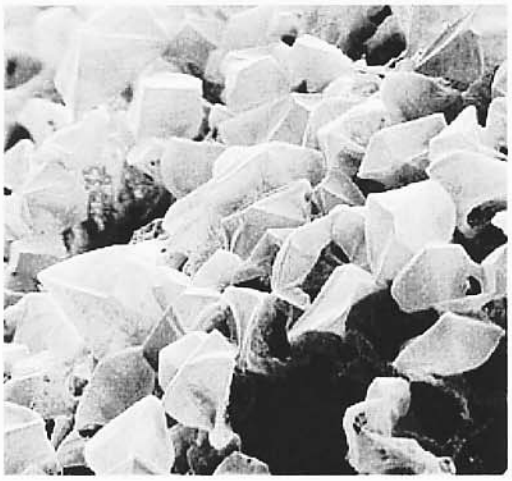
How EnviroBlasting Works

Lets start with what CO_2 blasting is:



It is a process in which dry ice particles are propelled at high velocities to impact and clean a surface. The particles are accelerated by compressed air, just as with other blasting systems. Today, most applications are able to use standard shop air, in the 80 - 100 psi range. If higher pressures are required, Enviroblast has equipment capable of blasting up to 300 psi.

How does it remove contaminants?

It depends on what you're cleaning. If you're removing a brittle contaminant such as paint, the process creates a compression tension wave between the coating and the substrate. This wave has enough energy to overcome the bonding strength and literally pop the coating off from the inside out. If you're removing a malleable or viscous coating such as oil, grease, or wax, the cleaning action is a flushing process similar to high pressure water. When the particles hit, they compress and mushroom out, creating a high velocity snow flow that actually flushes the surface.

How does this differ from how sandblasting works?

Sandblasting is similar to using an ice pick whereas dry ice blasting is similar to using a spatula. Sand cuts or chisels away the contaminant. Dry ice lifts it away.

What happens to the dry ice once it strikes the surface?

It sublimates and returns to the atmosphere as carbon dioxide (CO_2) gas. CO_2 is a naturally occurring element that constitutes less than 1% of our atmosphere.

What happens to the contaminant?

People sometimes think it disappears too, but it does not. All cleaning involves the relocation of dirt. When you mop a floor, the dirt moves from the floor to the mop to the water in the bucket. With dry ice, the dirt moves from an undesirable area to an area where you can better deal with it. If it is a dry substance, it generally falls to the floor where it is swept away or vacuumed during normal maintenance. If it is a wet substance like grease, you take a methodical approach similar to hosing down a driveway. You start at one end and guide the grease to the other end where it is vacuumed or squeegeed up.

Does the process damage the substrate?

Generally no, but it depends on the substrate. There is an energy threshold at which disbonding will occur and a threshold at which damage will occur. When the disbonding threshold is lower than the damage threshold, you can clean. If the reverse is true, damage can occur. Most of our applications deal with production equipment (cast iron, tool steel, tool grade aluminum), so there is no damage. We do have success with softer substrates such as plastics, wiring, pure copper, and fabrics, but these must be examined on a case-by-case basis.

Can CO_2 be used to clean hot online?

The process cleans best hot. Most contaminants have weaker adhesive strength when hot. In many applications, you may be able to clean three to five times faster hot than cold. In addition, because dry ice sublimates on impact, entrapment of the blasting media is not an issue. Grit entrapment is an important reason those who clean with sand, walnut shells, or other grit media cannot clean online.

Does the CO_2 cool the substrate?

Yes, but generally not as much as you might think. The amount of cooling is dependent upon three main factors: mass of the targeted surface, dwell time, and ice usage rate. Typically, a tire mold may start at 350°F and drop to 325°F during cleaning. With a very thin mold, the drop can be much greater. Generally, however, cooling is not a concern and only rarely does it affect cleaning performance.

Will the temperature drop damage the hot mold?

It depends on the mass of the mold. Large, heavy molds will not be harmed in any way because the drop in temperature is insignificant when compared to the mass of the mold. With thin molds where tolerances are critical, some testing may be required to determine if the drop in temperature would alter the structure of the mold.

Will the process create condensation?

Once again, it depends on the mass of the object you're blasting, your dry ice usage rate, and your dwell time. There will be condensation if you cool the substrate below the dewpoint (the dewpoint varies depending on local climate). Of course, if you're cleaning a hot mold it is rare to have condensation because you seldom cool the mold below the dewpoint. Condensation is not a factor 80% of the time. When it is, it can be dealt with quite easily. One method is to introduce heated air into the blast stream which usually eliminates condensation. This is a patented method possible only with Alpheus' two-hose system. A second method is the hot air knife which is also highly effective.

How is dry ice made?

It is made from liquid carbon dioxide. Dry ice exists as a liquid only under high pressure. When it drops to ambient pressure (the normal pressure that surrounds us), approximately half turns to gas and half turns to solid. The solid, usually in the form of fluffy snow, is then compressed to form dry ice blocks, pellets, or nuggets.

How are dry ice pellets made?

Pellets are made by taking liquid CO_2 from a pressurized storage tank and dropping it to ambient pressure to produce snow. The snow is then pushed through a die to make pellets. The system is a mechanical, circular process in which the pellet extrudes very slowly before coming into contact with a pin which breaks it off at a very uniform length. The other type of system uses a hydraulic ram to form "spaghetti" which breaks off at random lengths as it passes through the die.

How is block dry ice converted to blastable granules?

When you pull the trigger on Enviroblasts equipment, an actuator engages the ice, pushing it into the cutting face (the granulator) which produces particles that look much like raw sugar crystals, about 10 mils in size. Because the granulator only operates when the trigger is engaged, you only make granules as you need them. Any block that remains at the end of a given job can then be stored until the next job. Sublimation rates vary from 2-10% per day depending on storage conditions. A full block, properly stored, can still be useable several days later even after normal loss due to sublimation. The SDI-5 is a unique, patented system, the only blasting unit on the market capable of starting with block dry ice to create a blastable medium.

Does block dry ice have advantages over pellets?

Yes. Perhaps the most important advantage of block dry ice is consumption. The SDI-5 can clean more effectively at 1½-2 pounds of block per minute than our competition can at 4-5 pounds of pellets per minute. Over the course of a year, this could save tens of thousands of dollars in ice costs alone. Block has many other important advantages over pellets. It is easier to transport because pellets tend to compact in transport, causing them to clump. Block tends to be easier to get and is generally sold at a lower cost per pound than pellets. Block dry ice also has a longer shelf life. Pellets have a higher surface-to-mass ratio which makes them more hydroscopic, meaning they attract water. When stored, this causes them to clump, making them unusable. Additionally, the higher surface-to-mass ratio causes the pellets to sublimate (turn into a gas) faster than block.

Are there differences in the cleaning effectiveness of dry ice pellets vs. granules?

In about 75% of the applications, users do not choose dry ice media based on its cleaning effectiveness because there is little or no difference. In the remaining cases, pellets work better in some of the applications, granules in others. Generally speaking, pellets are more effective with thick hard to remove contaminants as the greater mass behind each individual particle more readily travels all the way through the contaminant to disbond it. Because the granules are smaller than the pellets, they produce a significantly greater number of surface impacts and are therefore better at removing paint. In addition, they are better for cleaning intricate patterns or tiny openings such as microvents in coreboxes.

Are some dry ice pellets better than others?

Dry ice pellets vary in uniformity of size and hardness. Alpheus is the only company in the industry that can deliver consistent, uniform pellets. This is due to inherent advantages in their pelletizing process.

Why is pellet uniformity important?

It is critical in ensuring repeatability of performance. There are many applications where pellets of a certain size and density deliver optimal performance. Once you determine the size and density that best suits a given application, only Alpheus systems can consistently deliver pellets to those precise specifications. Other pelletizing processes produce pellets with a much broader variance in pellet length and density, even within the same batch.

What is the difference between a one-hose system and a two-hose system?

In the Alpheus two-hose system, the dry ice travels in one hose and the high pressure air in another. The two are not mixed until just before the pellets exit the end of the nozzle. In a one-hose system the pellets and air are mixed together in one hose.The primary advantage of our two-hose system is reduced ice consumption. We deliver virtually all of our ice to the surface being cleaned. The one-hose system can stake no such claim. In U.S. government testing, it was determined that the one-hose system with a 25-foot hose lost 50% of its ice before reaching the surface. When the hose was lengthened, the losses increased. The Alpheus system can often save tens of thousands of dollars annually in dry ice costs alone when compared to one-hose systems.

How did the dry ice blasting technology originate?

It originated at Lockheed in the 70's when a coatings engineer, Calvin Fong, was researching ways to strip paint off aircraft. The technology did not become commercially available until Alpheus bought the license and patents from Lockheed and introduced it to the marketplace in 1987. Alpheus has led the way since then with many technological advances that have significantly impacted the industry.

How much dry ice should I expect to use?

This is an important question to ask because the amount of dry ice you need to clean effectively can vary dramatically within the industry. With Enviroblast equipment, most customers need 1½-2 pounds per minute while the trigger is engaged. Of course, when we are cleaning, we won't be pulling the trigger constantly. At a rate of 2 pounds per minute with 50% trigger time, we would use 60 pounds of dry ice in an hour.

How is dry ice blasting used in foundries?

CO_2 blasting equipment is used in foundries worldwide to clean coreboxes and permanent molds. Not only does dry ice blasting increase production by decreasing downtime, but it also eliminates mold damage, preserving the critical tolerances and greatly extending the life of the expensive tooling. You don't have to be an industrial giant to enjoy the cost benefits of CO_2. There are a large number of small to medium-sized foundries in the U.S. and abroad who successfully Enviroblast equipment to clean online.

What are some successful rubber molding applications?

Virtually every major tire manufacturer uses CO2 blasting equipment to clean tire molds. Enviroblasting is also useful to clean rubber molds for manufacturers of gaskets, o-rings, shoes, and many other products. A good rule of thumb in the rubber industry is, if you can see it, you can clean it with CO_2.

How is CO_2 used in the food industry?

CO2 is perfectly suitable for use in this industry because it is food grade quality, the ingredient that provides the carbonation in soft drinks. It is used to clean ovens, conveyor belts, molds, dry mixers, laminators, and packaging equipment.