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Romancing the Stone

Man-made diamonds are now so perfect they stump the experts. The diamond industry is hoping nobody notices.

By Michael Hastings
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Feb. 14 issue - Leo, a balding man with an Israeli accent, stands behind a glass counter in one of the hundreds of jewelry shops on 47th Street, the heart of New York's diamond district. Leo makes his living on the strength of his ability to evaluate the authenticity and value of diamonds. He is examining three small stones, each weighing less than half a carat—one pink, one colorless and a third, slightly green, called a marquise. He picks up the pink crystal between his index and middle fingers, places it gently on the counter and peers through his eyepiece—checking for the way the gem reflects light, its clarity and the shape and quality of the cut. He repeats the process for each of the other two stones. "They're real," he pronounces, handing over a business card with no last name. "They're very nice, but you're not going to retire on them. Come back when you have bigger rocks."

Leo's expertise, honed over years of buying and selling diamonds, has failed him. The gems he has just examined are not the product of geological forces acting over millions of years—they were made in a laboratory in Boston in a few days. But Leo is not the only dealer a NEWSWEEK reporter was able to fool. Yzhak Shemtov, who runs booth No. 51 in a crowded diamond exchange across the street, takes a long, hard look at the stones, and demands: "How much are you asking?" Alex, who has an office on the mezzanine of 67 West 47th Street, looks up from watching "The Price Is Right" on television. "Are you with the FBI?" he asks. Then he examines the putative diamonds through his eyepiece. "No, no, these are not synthetic," he says. Ten blocks north, across from Carnegie Hall, Lee Rosenbloom at Plaza Galleries puts the stones through a series of tests to check for cubic zirconia and moissanite, two popular diamond fakes. "They all check out," he says.

Reactions like those are making the diamond industry very nervous. There are now two technologies for making diamonds in a laboratory that are virtually indistinguishable from the natural crystals mined from the earth. Apollo Diamond, a Boston firm, has developed a method of growing perfect diamonds in a pressurized chamber, and plans to start selling colored and colorless diamonds this summer. Gemesis, a firm in Sarasota, Florida, has perfected a technology that uses high pressures and temperatures to mimic the way diamonds form naturally in the earth. Gemesis is now selling colored gemstones, including rare yellow and blue diamonds, for up to 75 percent less than the market rate for natural diamonds that are by most measures identical. At least three other companies are known to be working on these technologies. Mother Earth no longer has a monopoly on making diamonds.

What impact this development will have on the place of diamonds in our culture is unclear. Civilizations from the Romans to the Moguls of India have coveted these gemstones. Medieval European kings displayed them as symbols of virtue. Renaissance merchants hoarded them as status symbols. In modern times, diamonds have become the passion of future brides and scientists alike. How much does this value depend on place of origin—150 kilometers or so underground, then ferried up near the surface by billions of years of volcanic activity? How much does it derive from the gems' brilliant sparkle, the product of an octahedral crystalline structure that reflects light in just the right way? Diamonds, says George E. Harlow, author of "The Nature of Diamonds" and gem curator at the American Museum of Natural History, seem as if "they are created by God." Now that scientists can re-create God's brilliance in the lab, will we still prize them so highly?

While the fashion-conscious ponder this question, the diamond industry is in a swoon. More than with any other gem, the market for diamonds is based largely on an illusion. Contrary to their reputation as rare gems, diamonds are relatively common—sapphires and rubies, which are often priced below diamonds, are in fact thousands of times rarer. What makes diamonds expensive and sought after is a deft combination of marketing and carefully controlled supply among a few big companies.

Five diamond-mining firms—De Beers, Alrosa, Leviev, BHP Billiton and Rio Tinto—control almost 90 percent of the market, according to the Rapaport Diamond Report. The marketing is largely the work of De Beers, the world's largest diamond-mining company and creator of perhaps the most effective advertising slogan in history—"A Diamond Is Forever." Almost singlehandedly, De Beers has made diamonds a synonym for love and

an international symbol of commitment; today 85 percent of diamonds that are bought and sold in the United States are intended as gifts.

What happens if stones made in the lab flood the $60 billion diamond jewelry market, undercutting prices and puncturing the illusion of value? Other than cultured pearls, no man-made commodity has ever truly supplanted such a natural treasure; so-called synthetics could make diamonds as common as quartz. "If these synthetic-diamond manufacturers start putting a lot of stones in the market," says Robert M. Hazen, a scientist at the Carnegie Institution in Washington, D.C., "the diamond market could crash."

If the new diamond-making technologies were the brainchild of a single inventor, perhaps De Beers could buy them and lock them away in the company vault. But what's emerging now is the culmination of 50 years of trying to create the perfect diamond. The first breakthrough came in 1954 when Tracy Hall, a research scientist at General Electric in Schenectady, New York, invented a machine that recreated the high pressures and high temperatures that form diamonds in the earth. On Dec. 16, for 38 minutes, his device applied 100,000 atmospheres of pressure to a mix of iron sulfide and two seed crystals and produced some very small stones. They were as hard as real diamonds, and thus useful as an abrasive for industrial sanders. But they didn't dazzle the eye—their crystalline structure was too imperfect. Nevertheless, De Beers's stock plummeted after the feat was announced, according to Hazen, author of "The Diamondmakers."

The family-run firm, which was founded in 1888 and maintained a monopoly on diamonds through most of the 20th century, wanted to keep close tabs on any technology that had even a remote possibility of threatening its gemstone business. De Beers soon came out with its own diamond machine—a design so similar to Hall's that De Beers "must have used industrial espionage to get [it]," says Hazen. GE sued for patent infringement and, after a six-year legal battle, won an estimated $25 million settlement. By then, De Beers had launched itself into industrial diamond making; last year the company accounted for an estimated third of the $1 billion-a-year business.

Hall inspired other materials scientists to refine his original method. Using a massive press nearly two stories high, GE scientists were able to produce gem-quality diamonds in the late 1960s. But, according to Hazen, the equipment to achieve the enormously high pressures and temperatures necessary was prohibitively expensive—the machine took more than an entire week to produce a single one-carat diamond. As materials have improved, scientists have been able to fine-tune the process and lower costs. In 1989, a team of five Russian scientists based in Novosibirsk, Siberia, managed to create gemstones at the relatively low pressure of 60,000 atmospheres.

After the Soviet Union collapsed, Russian scientists began trying to attract investors. De Beers caught on in 1993, according to Victor Vins, a former Soviet scientist. "There was a big fuss," he says. "They invited me to London and to Johannesburg. They invited me to work with them as a consultant, and we did for a while. I think they just wanted to keep an eye on us." Carter Clarke, an American entrepreneur, got wind of the diamond making during a business trip to Russia. In 1996 he paid $57,000 for a "diamond-growth chamber" the size of a washing machine and founded Gemesis, which now makes diamonds at the rate of more than 100 carats a week.

While entrepreneurs scoured post-Soviet Russia, Robert Linares, the founder of Apollo Diamond, was secretly developing a different technology. The company had started out making diamond wafers for semiconductors as a replacement for silicon. Researchers modified a common technique in which diamonds are grown from tiny "seeds" in a superheated high-pressure chamber. A mixture of hydrogen and natural gas is added to the chamber, forming carbon atoms that settle on the seeds like dust on an old chair, and a crystal forms layer by layer. The engineers were delighted to find that this so-called chemical-vapor-deposition method, or CVD, could be made to yield clear, perfect gems—including colorless diamonds, which the high-pressure methods couldn't manage. Apollo, which made the three gems NEWSWEEK took to be evaluated, hasn't yet been able to make stones bigger than one carat, but promises to be making two-carat stones by 2006.

Apollo plans to start rolling out its diamonds in six months, most likely in partnership with luxury-jewelry designers. The gems will probably sell for 10 to 30 percent below the cost of natural diamonds. For the past two years, Gemesis has been selling its fancy colored diamonds for a fraction of the price of natural stones—$4,800 for a one-carat yellow diamond that would typically retail for $18,000. Although the equipment to make the man-made gems is pricey, experts say it's a bargain compared with opening a diamond mine. It's also many times cheaper for the manufacturer to get the diamonds to the store—the long supply chain from to mine to retailer is basically eliminated.

The newcomers won't say how low they could afford to price their diamonds, but they're no more eager than the big firms to see diamonds turned into a cheap commodity. Nor do they want to provoke the ire of the diamond establishment, which is already trying to portray the likes of Apollo and Gemesis as con artists passing off fakes to an unwitting public. Apollo and Gemesis say they're making "cultured" diamonds for a new type of customer who likes to "get frosted" or "wear a lot of ice"—a market that Apollo CEO Bryant Linares, Robert's son, puts at $2 billion a year. To keep things on the up and up, Gemesis laser inscribes labels on its gems so appraisers can see that they're not natural; Apollo says each cultured diamond should have a certificate of authentication.

De Beers and other established firms, by contrast, sneer at the market for what they call "synthetics." (The diamond makers prefer the term "cultured," as with the pearl industry, but have lost that battle in at least one court case, in Germany.) Stephen Lussier, executive director of marketing at De Beers, says the company's research has shown that 94 percent of women would choose "the real thing" over a synthetic diamond. Scientists may say the lab gems are identical chemically, physically and optically to natural diamonds, but, according to Lussier, they "don't understand what it is that makes a diamond valuable to the men who buy it and the women who receive it." De Beers has begun to insist in its marketing campaigns that only diamonds forged by the earth's geology are authentic.

Will the distinction between man-made diamonds and natural ones eventually disappear? The answer may hinge on whether De Beers can come up with a cheap and easy way of telling the two apart. Doing so conclusively currently entails a battery of high-tech instruments that's beyond the pale for most diamond appraisers. Gemologists at the International Gemological Institute, a New York-based firm, used a high-powered microscope on the diamonds provided by Apollo to look for inclusions—tiny marks a diamond would acquire underground while it was being formed. A diamond that's too clean (or too perfect, as Bryant Linares would have it) might be man-made—or it could simply be a very clean natural diamond. IGI then used a $40,000 machine to shoot a mid-infrared light through the diamonds to analyze the distribution of nitrogen atoms.

IGI next ran the diamonds through two devices supplied by De Beers. The first, called DiamondSure, checks the nitrogen content as well. The second, DiamondView, looks at a diamond's "growth structure" by illuminating the gem with a high concentration of ultraviolet light. The test can reveal a diamond made by high pressures, but it's stumped by Apollo's CVD diamonds, in which carbon atoms are formed more similarly to natural diamonds. In the final test—on a machine that costs $100,000—the IGI gemologists cooled a diamond in liquid nitrogen so an even more accurate reading could be taken. They then shot a laser through it and analyzed the wavelength. A natural diamond would measure a wavelength of 741 nanometers; Apollo's CVD diamond measured 737.

What happens when less scrupulous businesses start to get hold of these diamond-making technologies? High-pressure diamond presses could be made to fit on a desktop. Many semiconductor firms are to keen to get the latest CVD technology; it seems only a matter of time before other engineers figure out how to use it to make perfect diamonds. Whatever new tests are developed, manufacturers are sure to find ways of fooling them. They might tweak the technology to add inclusions to their diamonds, or small amounts of nitrogen. The detection challenge is like "a cat-and-mouse game," says David Weinstein, executive director of the IGI.

Don't count De Beers out yet, however. The company has been developing its own CVD technology and is closely studying high-pressure techniques. Should gem-quality synthetics puncture the diamond market, De Beers will most likely be well placed to jump into the game, with far greater technological and marketing resources than any other player. No doubt diamonds are forever. It's just not clear which kind.

With Henk Rossouw in Johannesburg, Joanna Chen in Jerusalem and Frank Brown and Nadya Titova in Moscow

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