

# EXPLOSIVE RESULTS

## Questing for the Holy Grail of High Explosives



Explosives chemist David Chavez has developed new explosives molecules that offer high energy with enhanced safety—they cannot be detonated by spark, friction, or impact. (Photo: Los Alamos)

The perfect material for detonating nuclear weapons, arming a conventional bomb, mining ore, and even propelling a rocket into space has two seemingly paradoxical characteristics: releasing tremendous energy on demand while resisting accidental detonation and remaining stable for its intended life cycle.

That combination of qualities is the Holy Grail in explosives research, according to Los Alamos scientist David Chavez of the High Explosives Science and Technology group—and he’s on a promising quest to find it.

In a recent breakthrough, Chavez invented a molecule that could herald the arrival of a new class of insensitive high explosives. The new compound performs nearly as well as conventional explosives but can’t be detonated by a spark, friction, or impact.

Chavez’s work exemplifies the sometimes-trying trial-and-error progress of scientific research. Chavez was pursuing his idea for uniquely arranging carbon, hydrogen, nitrogen, and oxygen—the basic building blocks of all explosives—into a novel molecule. Along the way, he stumbled through several failures before hitting on the right configuration of atoms. He found that extensive hydrogen bonding among the molecules created a “glue” strong enough to bind them

but weak enough that an unwanted striking force, spark, or friction can separate the molecules without triggering a detonation. That quality makes them safer to handle and use than conventional explosive materials.

As Chavez’s work shows, Los Alamos researchers are constantly deepening their understanding of the basic science underpinning the performance and behavior of explosives (and propellants, too). Those research results then guide new problem solving to support the national security mission of the Laboratory. Developing new explosives with tailored properties, including enhanced safety, has been a primary focus of the Lab’s science and engineering efforts since the days of the Manhattan Project. Today, these efforts continue to ensure the viability of the nuclear stockpile, improve conventional explosive weapons, and better position the United States to assess threats from foreign-made explosive materials, according to Chavez.

On a personal note, Chavez adds, the Laboratory environment gives him the opportunity to explore his ideas about explosives: “One of the great things about Los Alamos is having the ability to push the frontiers, to do the new thing that no one’s been able to do before.” ✦

~Charles C. Poling