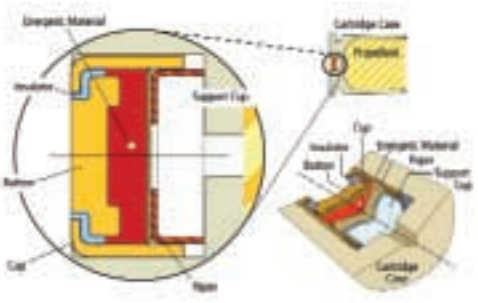
Get the Lead Out

China Lake Developing a Lead-Free Primer for Ammunition

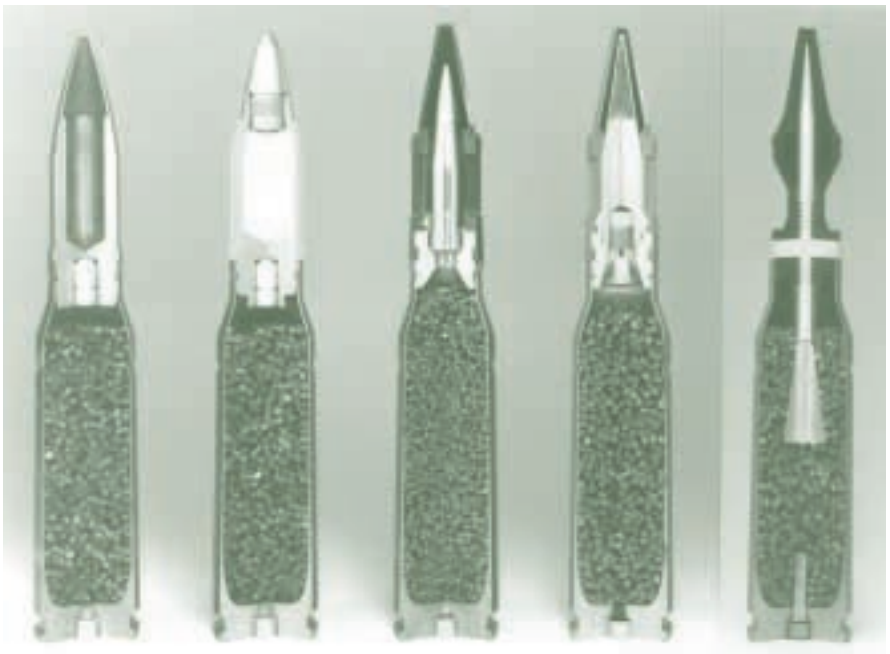


M52 electric primer.

The Strategic Environmental Research and Development Program (SERDP) is sponsoring a project to develop a lead-free electric primer (LFEP) formulation for aircraft medium caliber ammunition.

In the early 1990s researchers at the Naval Air Warfare Center (NAWC), China Lake, CA, were investigating issues related to military percussion primers for aircraft ammunition. At the same time, researchers from the Los Alamos National Laboratory (LANL) were looking for applications suitable for a new class of materials called Metastable Interstitial Composites (MIC), which consisted of nanoparticles of aluminum and molybdenum trioxide. The properties of MIC materials seemed an ideal solution for primers with the added benefit of eliminating the hazardous materials like lead styphnate and lead azide.

A driving force behind the investigation of an alternate primer material is the recognition that the processing and use of primers containing traditional lead compounds, and other toxic materials, is a significant source of pollution that endangers the health and welfare of production workers, end users and potentially third party members of society. Contamination of the atmosphere, the soil and ground water represents serious threats to those that live and work in the proximity of such lead containing materials and by-products. Although an individual primer by itself contains only minute amounts of lead styphanate and other pollutants (barium nitrate, trinitroresorcinol, etc.), in the aggregate, the exposure levels can become a threat to those that manufacture, handle and use these items on a frequent basis. As an example of the hazards that these compounds can lead to, results of Army studies indicate that the combustion of primers is responsible



Medium caliber ammunition.

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for 20 percent of the airborne lead released at firing ranges. The other 80 percent of airborne lead contamination is due to lead particulates released when lead containing projectiles pass through the barrels. However, medium caliber ammunition projectiles do not as a general rule contain lead. This study also shows that 40 percent of the inhaled lead is dissolved in the bloodstream and 10 percent is absorbed by the body. Once lead is absorbed in the body it becomes very difficult to remove. Repeated exposure results in further accumulation of lead in the body.

The idea of directly substituting the MIC materials for the current heavy metal primer formulations was presented to Army researchers who were addressing similar problems under the related "Green Ammunition" Program sponsored by SERDP. The potential for MIC materials in military primers was immediately recognized and several groups from both Army and Navy research laboratories, in conjunction with the MIC researchers at LANL, began efforts to eliminate lead products in primers through the application of MIC materials. Shortly after introducing the idea of utilizing MIC materials for lead-free primer mixes, the researchers at NAWC China Lake and LANL were awarded a patent for lead-free percussion primers based on MIC technology.

Medium caliber ammunition.

With the same basic lead-based materials being used in electric primers for medium caliber ammunition, the researchers at NAWC China Lake felt that substituting MIC materials could also resolve these same environmental issues in aircraft ammunition while maintaining performance requirements. A SERDP Exploratory Development (SEED) program was proposed to demonstrate the feasibility of incorporating an MIC formulation in the M52A3B1 electric primer used in 20mm aircraft ammunition. During the subsequent SEED program, it was discovered early in the effort that an additional additive for electrical conductivity was required to obtain proper performance of an electric primer based on MIC materials. It was also noted that special attention to formulation, characterization and aging properties of the MIC-based formulations would be critical to the successful development of an MIC electric primer. The successful demonstration of an electric primer concept and formulation based on MIC technology under the SEED effort led to a 4-year SERDP program to optimize a potential lead-free electric primer formulation that could lead to eventual production. ⚓

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