



B160 Characterization of Trace Elements in Gunshot Residue of Lead Free Primers Winchester, Winclean, and Remington

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Attendees will gain a comparative understanding of the gunshot residue particles produced during firing bullets having lead free primers manufactured by Winchester, Winclaen, and Remington.

This presentation will impact the forensic community and/or humanity by demonstrating a systematic analysis, of gun shot residue (GSR) from primers and ammunitions in the area surrounding bullets holes and from the shooter's hand. This is a very important tool to determine the shooting distance, types, of the primer and ammunitions to the forensic scientist.

A comparative study of the gunshot residue particles produced during firing bullets having lead free primers manufactured by Winchester, Winclaen, and Remington were performed. Morphology and composition were analyzed using scanning electron microscope equipped with energy dispersive x-ray.

The effect of lead pollution caused by the use of bullets and primers containing lead is one of the greatest problems facing the law enforcement and the military. Therefore attempts have been in progress to eliminate lead based primer mixtures and bullets. The recent development of lead free ammunition and bullets represent a new challenge for ballistic specialists and forensic scientist. Much research work has been carried out and published on lead based GSR but, only very few research studies have been reported in the analysis gunshot residues produced from lead free primers during firing.

In this context this research is a study of the topography, morphology, and composition of the residues deposited during firing using lead free primers and ammunitions. Attempts have also been given to detect and estimate the amount of various constituents in the given ammunition and also to correlate the results to forensic examination.

Test firing, collection of gunshot residues, and subsequent analysis were carried out at the Forensic Science Laboratory of the Albany State University. A specially made bullet trap filled with polymer fibers was employed for live firing. The firearms used in this study were a Springfield Armory 0.45 caliber (model 1911) and a Beretta 9mm Parabellum (model 92 FS.CaC). Two types of ammunition, 9 mm and 45 ACP, used in this study were manufactured by Winchester (Win Clean) and Remington. Firing distance and the area surrounding the target are the two parameters used in the collection of gun shot residues. A total of 60 rounds were fired in this study. Imaging and compositional analysis were performed on a Cam Scan 44 scanning electron microscope equipped with energy dispersive xray detector.

Spherical and Non-spherical particles with size in the range 330 1m are studied for intensity, distribution and composition of gun shot residue particles. Intensity and distribution are studied as a function of shooting distance and collection areas. Number of particles on the shooter's hand is high, compared to those collected from different areas of the target. The elements identified from the GSR particles of Winchester Winclean primers are Potassium, Calcium, Aluminum, Chlorine, Sodium, Copper, Zinc, and Silicon where as Remington constitutes Copper, Zinc, Magnesium, Chlorine, and Silicon. Composition variations are based on the size and shape of the GSR particles. Nonspherical and large particles always composed of more than three elements. Small and spherical particle contains either one or two elements. Attempts have been made to distinguish between Remington and Winchester Winclean GSR particles in terms of composition and morphology.

Both types of GSR particles contain Copper and Zinc alone or in combination with other respective elements. This is because of the brass plated cartridge or the brass firing pin. Lead and barium is also found in both types due to use of previously fired gun. Morphology and size do not show any differences in their intensity or distribution. Characteristic GSR particles having spherical, spherical with dimples, oval, and irregular shapes are common in both types.

Gun Shot Residue, Scanning Electron Microscope, Lead Free Primers