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Title: Foamed Celluloid technology

Abstract Text: Celluloid is a class of compounds based upon nitrocellulose, a highly flammable compound formed by nitrating cellulose through exposure to nitric acid, or another strong nitrating agent. Celluloid consists of about 70-80 percent industrial grade nitrocellulose (nitrated at ~11 % nitrogen content) and 20-30 percent camphor. The nitrocellulose and camphor are combined in the presence of solvents, such as ethanol, in a horizontal mixer, followed by straining, roll milling and “hiding”. A selected number of “hides” are then blocked (consolidated) under pressure and at elevated temperature into a fused block. After a conditioning period, the block is then sliced into sheets at desirable thickness and the sheets dried to remove all residual solvents. The dried sheet is now ready for molding. NATO has adopted the use of non-porous celluloid in mortar increment containers as a replacement to nitrocellulose felted fiber. Celluloid is not significantly affected by moisture, is easily moldable, and above all relatively low cost. However, there are performance problems with celluloid: embrittlement at cold temperatures and residue accumulating in the mortar tube. An alternate celluloid material, foamed celluloid, solves issues that associated with celluloid: foamed celluloid possesses a larger surface area which significantly improves the burn rate; and the cellular structure of the foamed celluloid enhances the impact resistance of the material allowing it to become substantially robust. The use of foamed celluloid is being considered for several military applications and end items. This paper will discuss all the potential military applications that may use foamed celluloid material in the future, and the feasibility associated with the manufacture and processing of this novel material. It will also include information on the state of the art pilot plant facility established at ARDEC to process the advanced foamed celluloid material using vacuum forming to convert the novel material into 60mm, 81mm, and 120mm Mortar Increment Containers for testing and qualification. The pilot plant at ARDEC has the capability to produce hundreds of parts daily and can be easily scaled up to meet high production demands.