How detectable are metal and x-ray detectable plastics?

Boedeker Plastics, Inc.

Jeff Hendrickson

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ENHANCING FOOD, BEVERAGE & PHARMACEUTICAL MANUFACTURING SAFETY WITH METAL & X RAY DETECTABLE PLASTICS

Recalls due to foreign contamination in food, beverage or pharmaceutical products can be dangerous to consumers and detrimental to business. The cost of a recall due to metal or plastic contamination can be financially impactful and have a long term damaging effect on a manufacturer and its brand. For companies that utilize metal or x-ray detection systems, metal & x-ray detectable plastics are an excellent choice to enhance food safety.

As more food processing and pharmaceutical companies incorporate metal and x-ray detection systems to help detect and prevent contamination, it is critical that all parts in the manufacturing process that are in involved in the manufacturing process are detectable with these systems. Typically, many of the existing plastic parts or components in the process are not detectable, which pose a significant contamination threat should these parts fragment and enter the food or product source.

In order for the detection system to bring the full value in enhanced food safety, it is critical to use detectable materials or components that come in direct contact with the food or product source. Stainless steel has been a popular choice in many applications and is an excellent choice in many situations. However, in many applications plastics are preferred due to improved chemical resistance, lower friction or eliminating wear by using plastic against a dissimilar material like stainless, or other benefits offered with plastic materials. In these situations, were plastics are preferred, it is imperative to use metal or x-ray detectable plastics to ensure the food source is protected from possible contamination.

WHY IS THE LEVEL OF DETECTABILITY IMPORTANT?

In the last few years, metal and x-ray detectable plastics have been developed and are being utilized more and more in direct product contact applications in the food, beverage and pharmaceutical industries for enhanced food and drug safety. Unfortunately, often overlooked or misunderstood is the level or size at which these metal and x-ray detectable plastics are detected. Detectable plastics cannot and will not be detected at the same levels as stainless steel or other ferrous and non-ferrous metals, making it important to understand the actual detectability levels of plastics.

It is critical that the end user understands the level of detectability of these materials to ensure that they are detected by the metal and x-ray detection equipment in their individual process. The FDA mandates that a 7mm piece of plastic must be detected with 100% accuracy and in most cases, detectable plastics exceed this requirement.

WHAT MAKES A PLASTIC METAL OR X-RAY DETECTABLE?

To understand the level of detectability we must first consider the additives used to make these materials detectable. Minerals containing Barium (Ba) and metal powders are compounded with various plastics to make them visible to X-ray and metal detection machines. In order to maintain the physical properties of the plastic material the additive can only be added to a certain percentage of the overall compound. A careful balance is achieved to provide detectability and maintain physical properties of the base plastic material.

WHAT SIZE IS TYPICALLY DETECTABLE FOR X-RAY & METAL DETECTABLE PLASTICS?

Our materials partner, Röchling Engineering Plastics has conducted several studies over the last few years using industry leading detection equipment to define reference sizes that can be reasonably expected in any processing application. Testing was conducted using INSPX X-Ray & Safeline Metal Detection equipment along with Röchling's Polystone® and Sustarin® MDT and XDT plastic sheets and rods. Based on these studies, the x-ray and metal detectable plastics can be seen as small as a 2mm cube, but keep in mind the detection settings, product type, and other environmental factors will influence the actual size for each individual application.

For visual comparison, see the below image which shows a typical 3mm cube of detectable plastic between two coins for reference. This is a good rule of thumb for estimated detectable size, but the following pages will provide more insight on detectable levels in both x-ray and metal detection processes. Keep in mind that since each process and product have different environmental variables, it is the end user's responsibility to define settings and detectable size expectations for their application.

VISUAL REFERENCE

3MM POLYSTONE® M XDT (X-Ray Detectable UHMW)

DETECTABILITY OF METAL DETECTABLE PLASTICS

When looking at metal detection, the below chart was developed by Röchling Engineering Plastics which compares Sustarin® C MDT (Acetal) and Polystone® M MDT (UHMW) to common metals. Detectability will vary based on machine settings and the product being inspected. For comparison, each metal detectable plastic is compared to Ferrous, Non-Ferrous, & Stainless steel. Typically, food processors will use 1 mm stainless steel as a standard detection goal meaning that in that same processing environment, a 2.45 mm fragment of Sustarin C MDT would be expected to be detected as indicated by the chart.

METAL DETECTION MATERIALS COMPARISON

Sustarin® C MDT (Acetal)

Ferrous (Sphere mm)	Non-Ferrous (Sphere mm)	Stainless Steel (Sphere mm)	Sustarin® C MDT (Cubed mm)
0.70	0.70	1.00	2.45
0.80	0.90	1.10	2.80
0.90	1.00	1.20	3.15
1.00	1.20	1.50	3.50
1.20	1.32	1.58	4.20
1.30	1.50	1.90	4.55
1.50	1.60	2.20	5.25
1.60	1.80	2.40	5.60

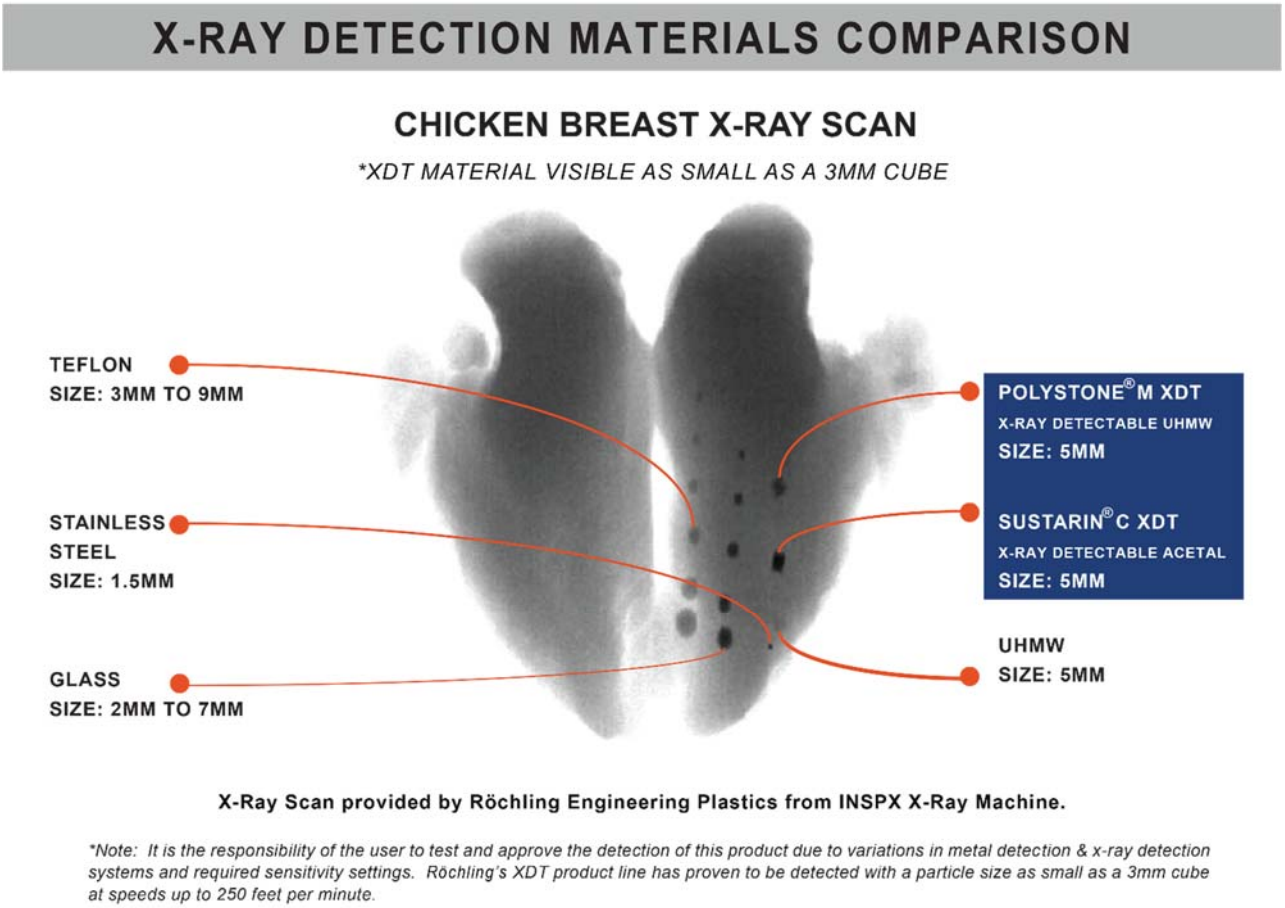
Polystone® M MDT (UHMW)

Ferrous (Sphere mm)	Non-Ferrous (Sphere mm)	Stainless Steel (Sphere mm)	Polystone® M MDT (Cubed mm)
0.70	0.70	0.80	2.33
0.80	0.80	1.00	2.66
0.90	0.90	1.10	3.00
1.00	1.00	1.20	3.33
1.20	1.20	1.50	4.00
1.30	1.27	1.60	4.33
1.50	1.50	1.80	5.00
1.60	1.60	2.00	5.33

Note: This test was designed to provide an estimate for the size of Sustarin® C MDT or Polystone® M MDT that could be detected in any product using Safeline Metal Detectors when the Ferrous, Non-Ferrous, or Stainless Steel standard detection size is known. It is reasonable to expect the corresponding equivalent conductive material of Sustarin® C MDT or Polystone® M MDT detected as well in the same product under same testing conditions.

DETECTABILITY OF X-RAY DETECTABLE PLASTICS

A good reference for X-Ray detectability is the below INSPX X-RAY SCAN – which shows several materials that are visible and invisible to x-ray. The darker that an image shows, the more easily detected it is. As points of reference, dense materials like Stainless and Glass are easily visible in the scan but the unfilled UHMW is nearly invisible and would not be detected. Both the Polystone® M XDT (UHMW) & Sustarin® C XDT (Acetal) are easily visible in this scan and would trigger a reject. Subsequent testing showed fragments as small as a 3mm cube at product line speeds up to 250 feet per minute.



X-Ray Scan provided by Röchling Engineering Plastics from INSPX X-Ray Machine.

**Note: It is the responsibility of the user to test and approve the detection of this product due to variations in metal detection & x-ray detection systems and required sensitivity settings. Röchling's XDT product line has proven to be detected with a particle size as small as a 3mm cube at speeds up to 250 feet per minute.*

BOEDEKER PLASTICS, INC.

Since 1984 we have specialized in the Food, Beverage and Pharmaceutical Industries. We have many years of experience in working with automation OEMs and end user processors in solving challenging applications with plastics that have proved to reduce downtime and enhance food safety in many applications. Our ISO 9001 & 13485 certified facility offers a complete inventory of FDA grade plastics and metal and x-ray detectable plastics that are backed by over 75 CNC machines that offer precision machined parts. Our Technical Staff can assist with onsite consultation by application, technical seminars, material selection by application, part design, material supply, prototype part and production part supply.