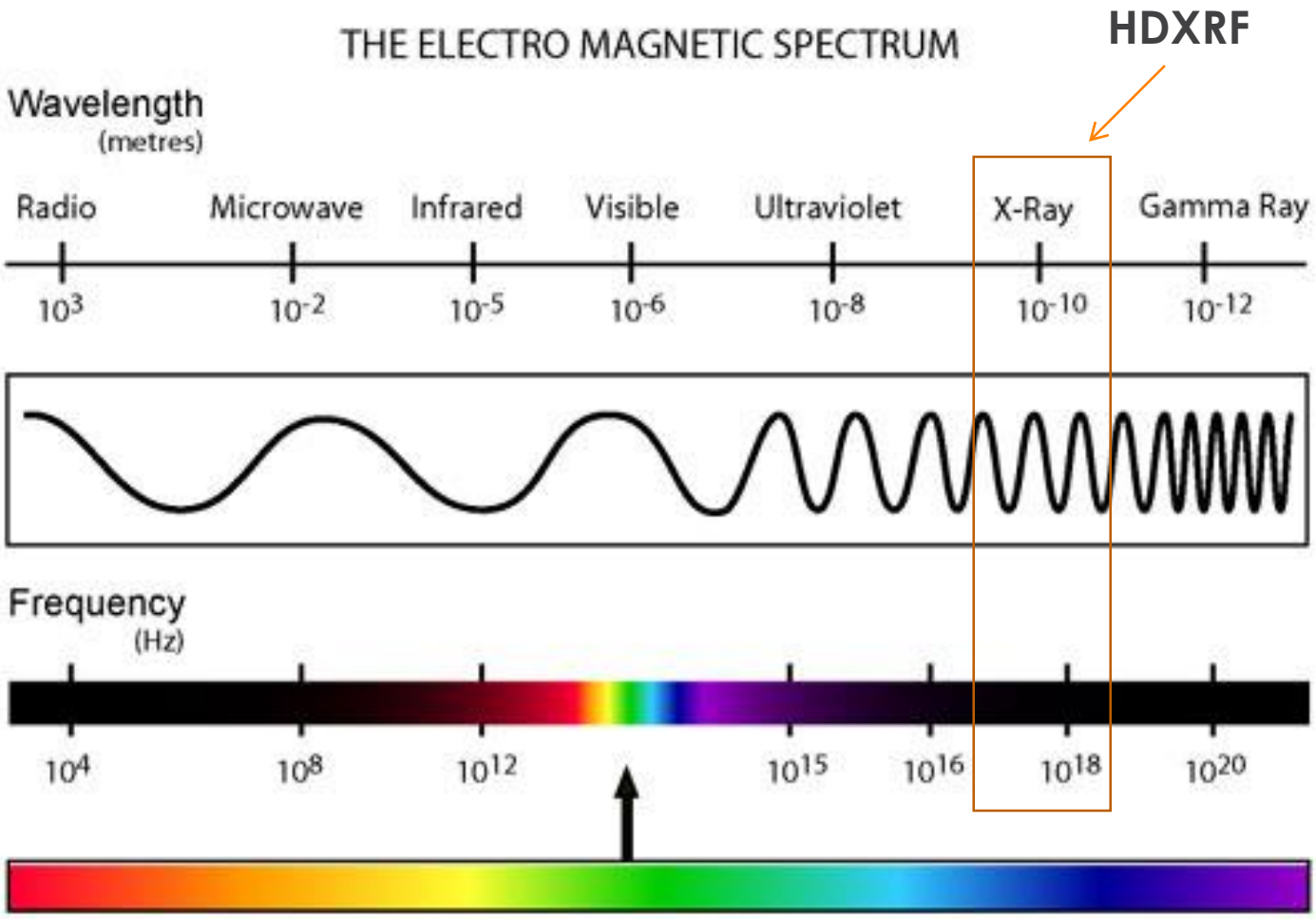
Introduction to HDXRF

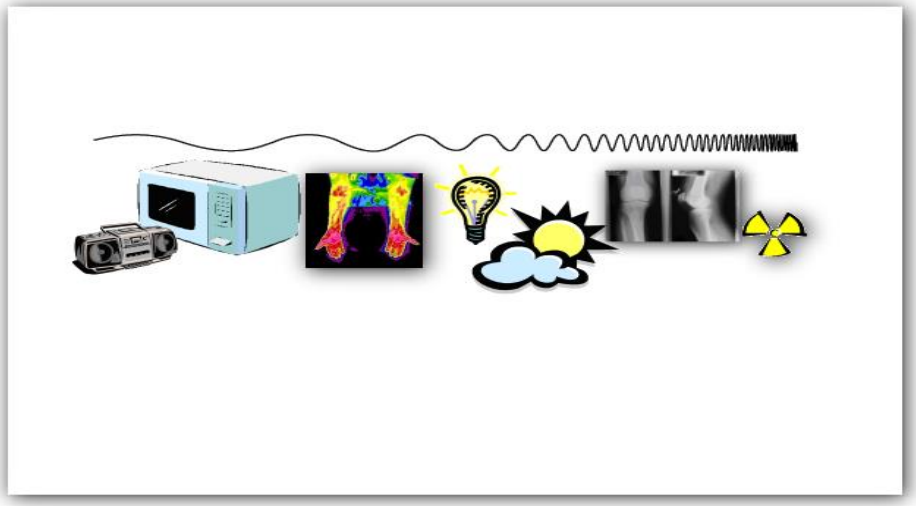
How HDXRF delivers industry-leading performance

Electromagnetic Spectrum

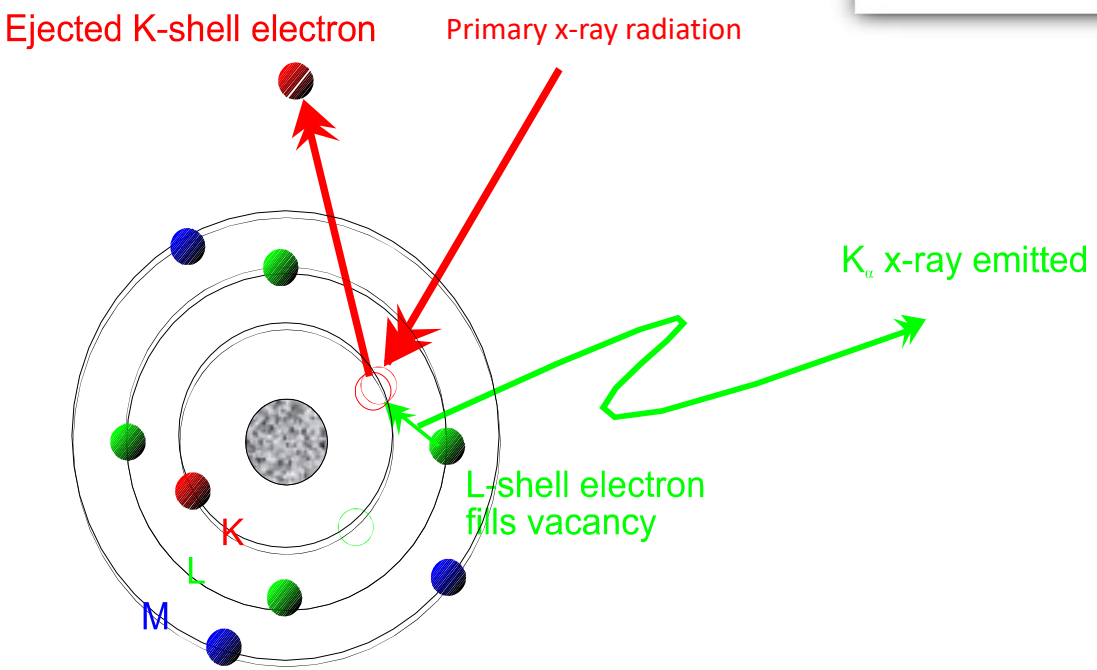


XRF Technology

X-Ray Wavelength: 0.01~20nm



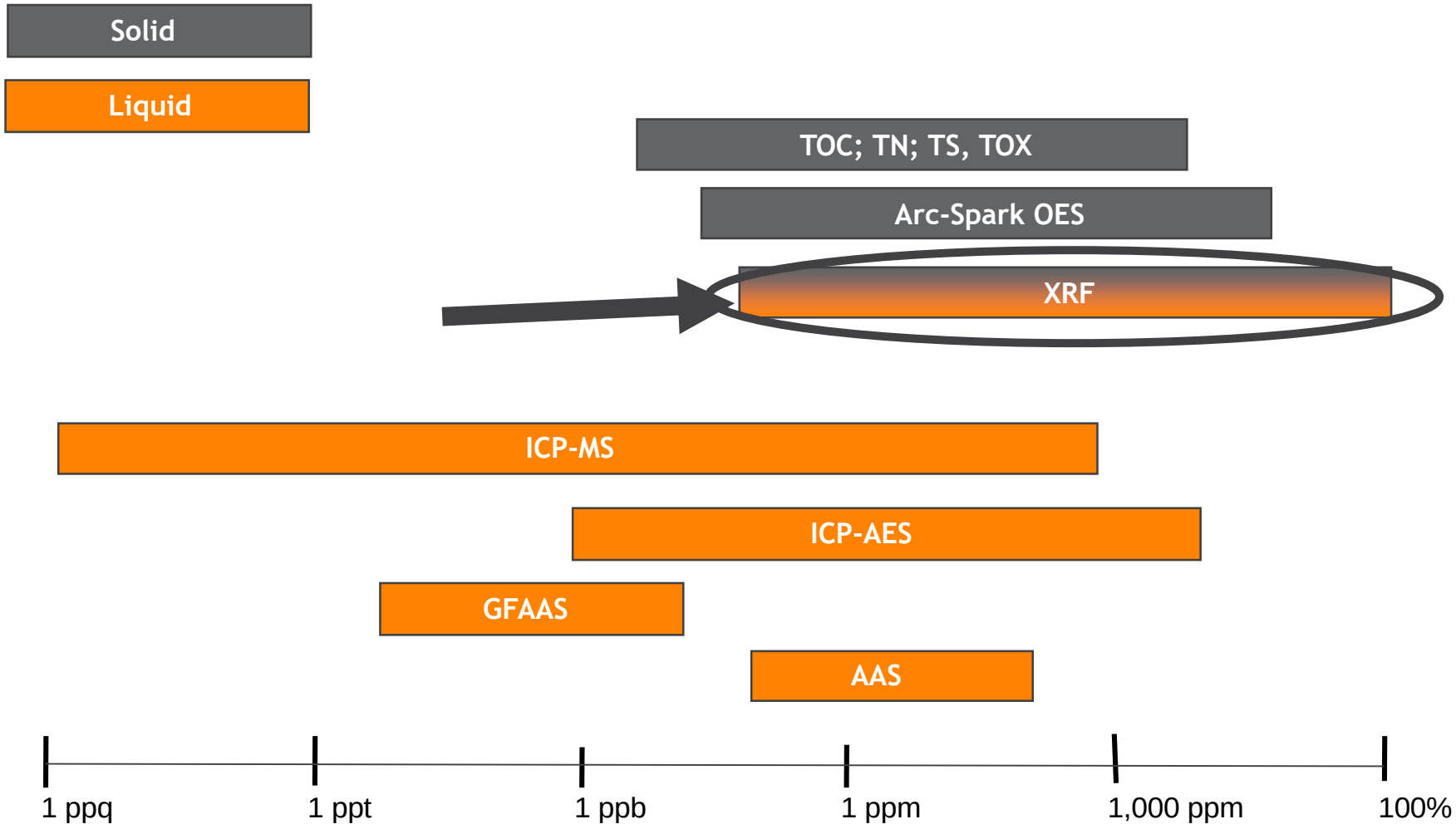
XRF Principle



X-Ray Interactions:

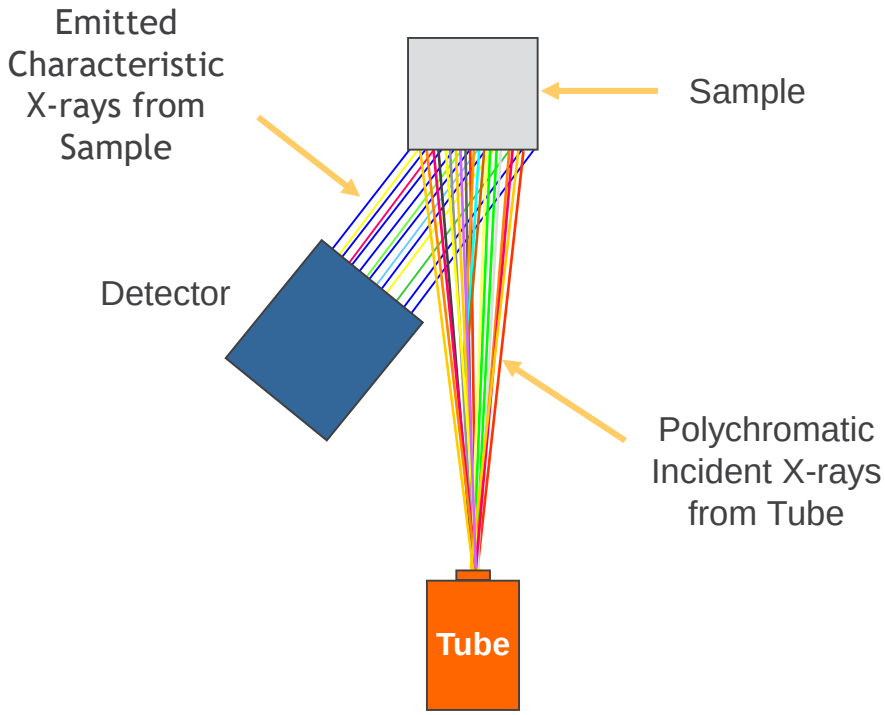
- X-ray Fluorescence
- Scattering

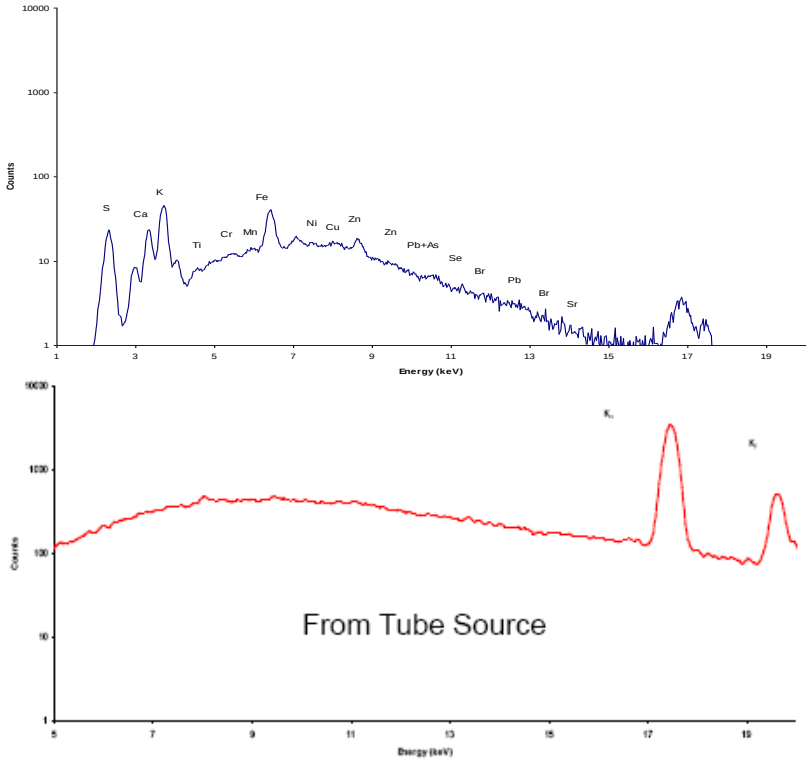
Analysis Range



Element Range: From Al to U

Traditional EDXRF

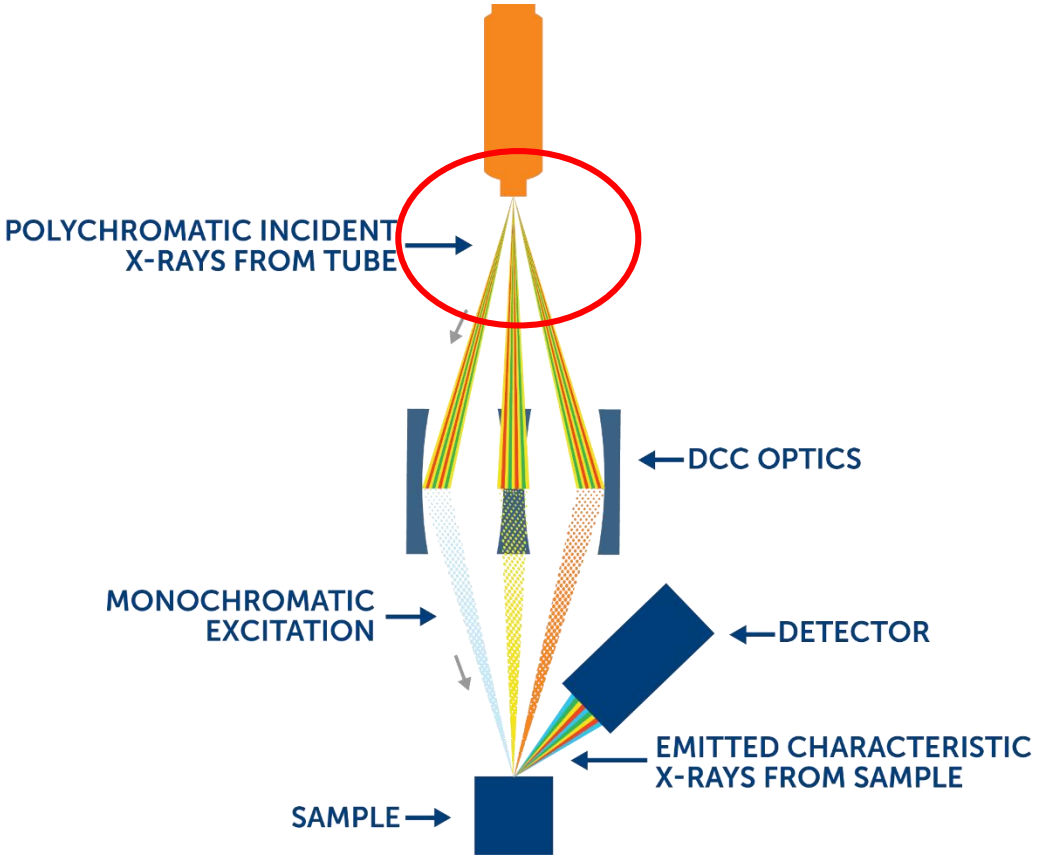


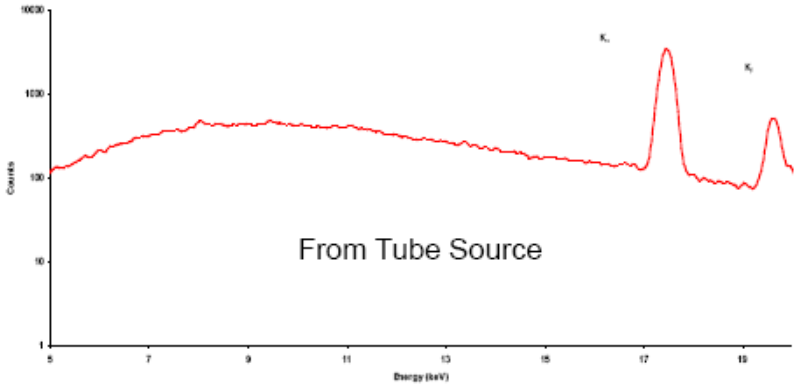


- Dispersed beam is not intense at sample surface
- Low limits of detection challenging with high background from X-ray source
- If a filter is used to achieve monochromatic excitation, the intensity of the excitation beam is significantly reduced – lower signal at detector, poor sensitivity, and higher limits of detection

HDXRF Technology

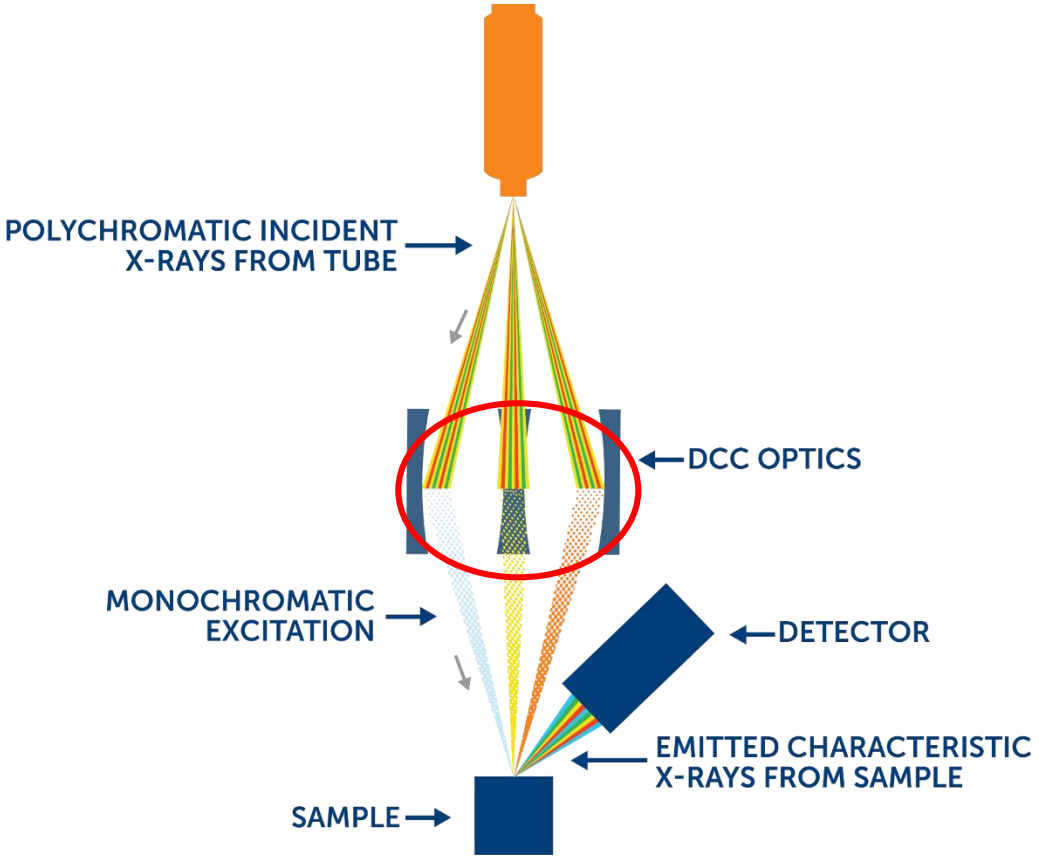
HDXRF

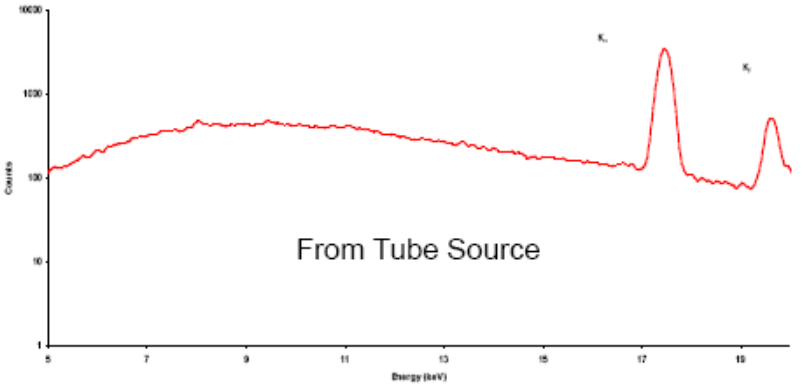


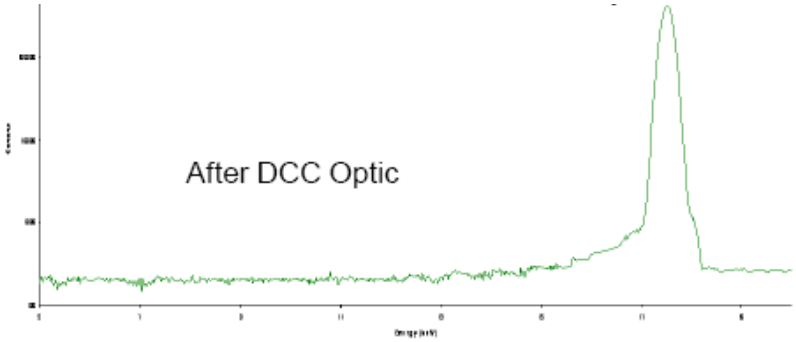


HDXRF Technology

HDXRF

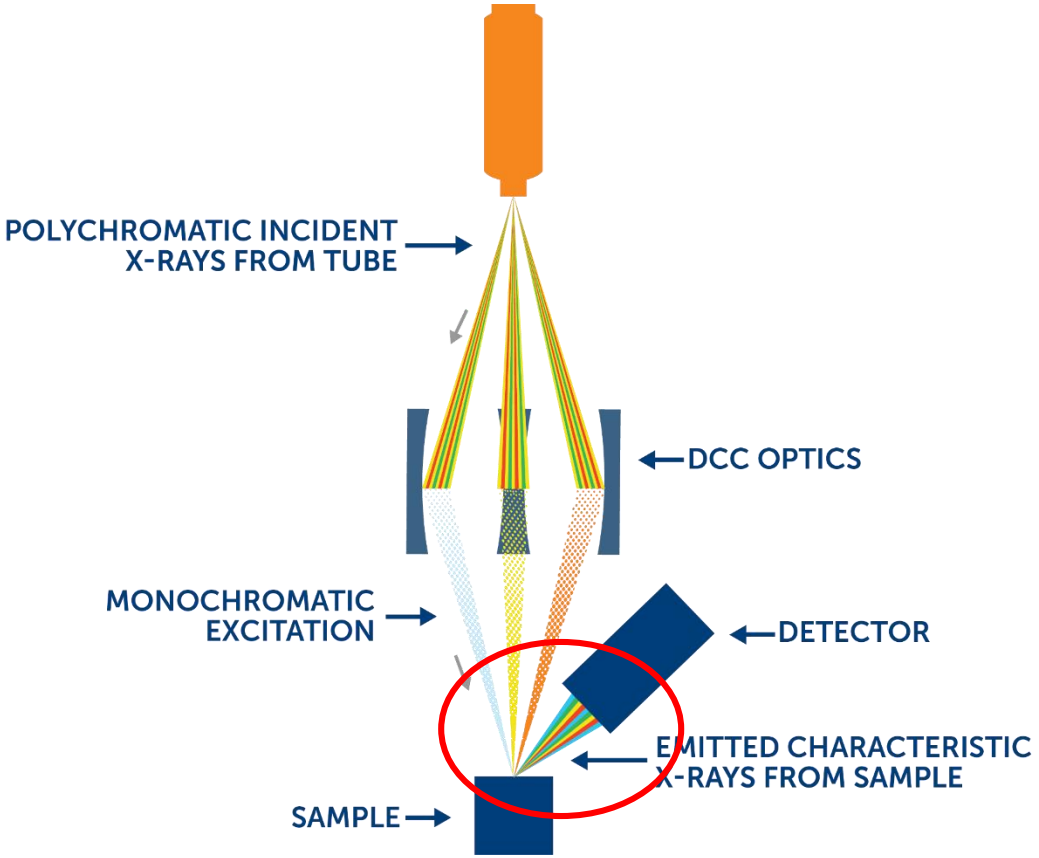


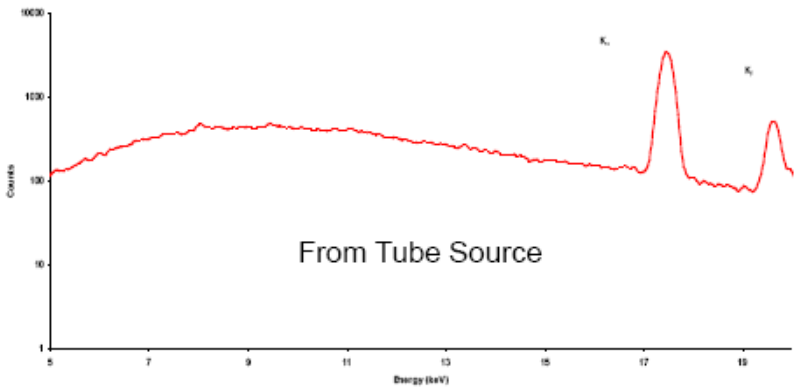


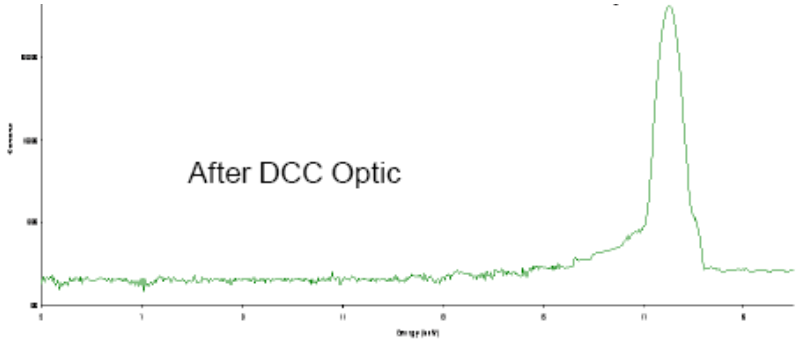


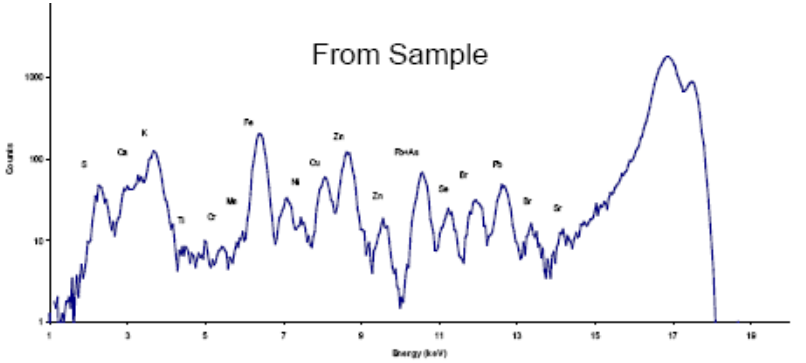
HDXRF Technology

HDXRF

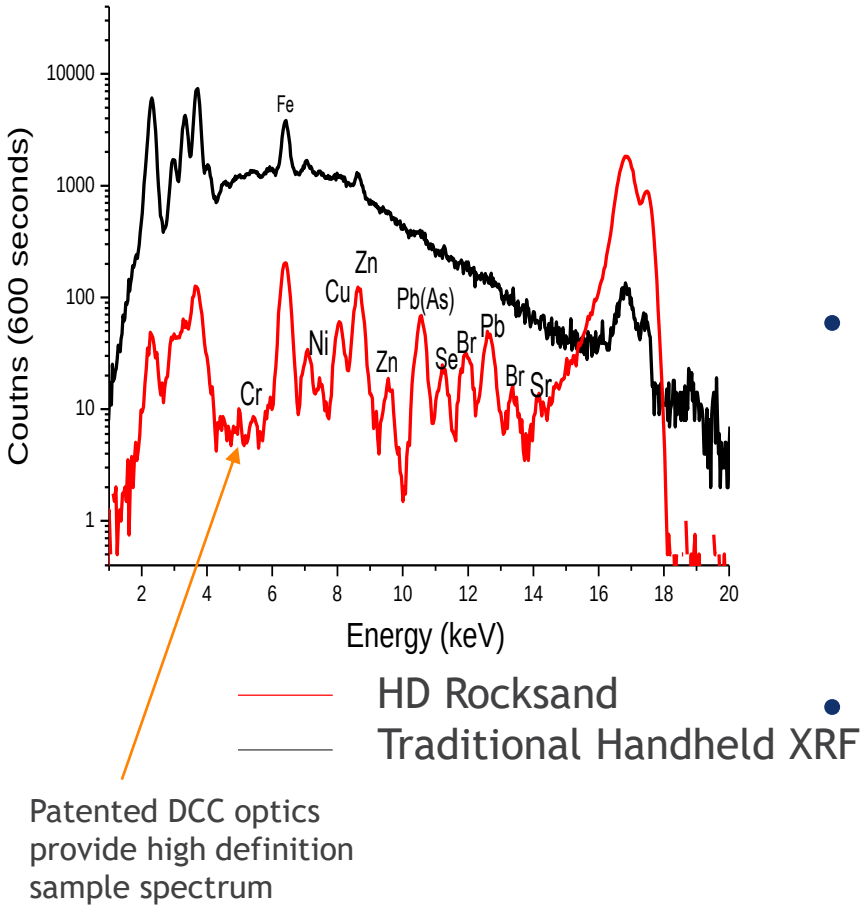








HDXRF Technology

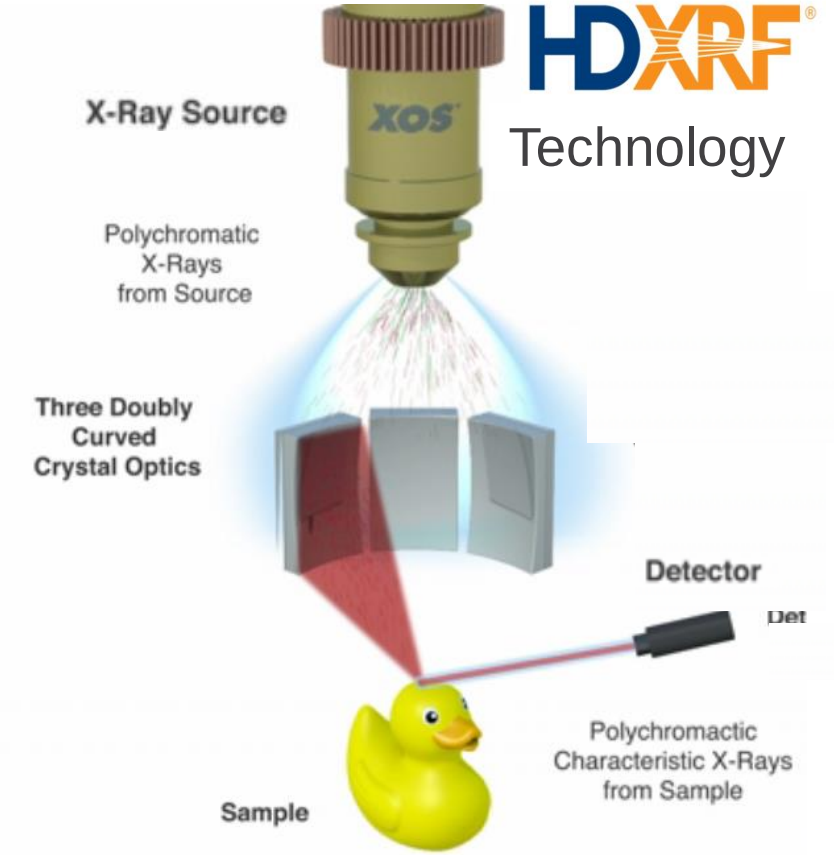


- Patented **Doubly Curved Crystal** optics eliminates background scattering, vastly improving precision and accuracy.
- Improved signal definition reduces interferences from elemental and physical matrix effects.
- Better Fundamental Parameter software method based on monochromatic X-RAY excitation.

High Definition X-Ray Fluorescence (HDXRF®) provides enhanced measurement and precision using patented DCC optics.

HDXRF features and benefits include:

- Elimination of the scattering background resulting in greatly enhanced elemental detection limits
- Ability to quantify toxic element concentrations for both the coating and the base materials separately
- Multiple DCC optics resulting in an intense and focused beam on the product surface—a 1-mm analysis area



Where HDXRF Wins

HDXRF® is particularly suited to assist in meeting the tightening tolerances for consumer products—toys, jewelry, apparel, and electronics—offering ***unprecedented limits of detection*** of potentially toxic elements.

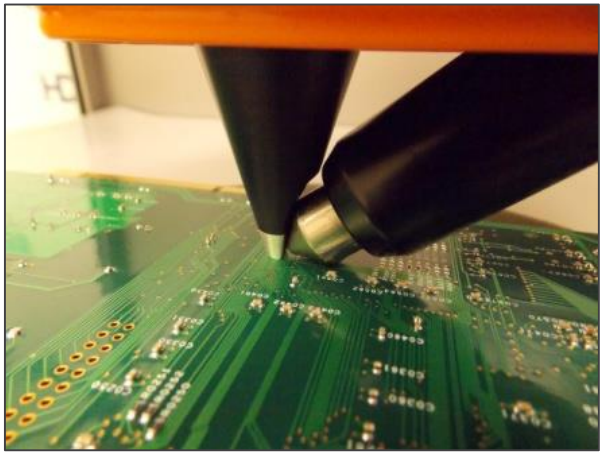
LOD in ppm	Pb	Cd	Cr	As	Br	Sb	Se	Hg	Ba	Cl
Plastic Substrate	0.8	2	2	0.8	1	5	1	1	10	100*
PVC Substrate	1	2	5	1	1	5	1	2	10	N/A
Coating on Plastic	5	50*	15	5	5	100*	5	8	100	150*
Metal Substrate	10	5	15	8	N/A	15	5	10	200	N/A
Coating on Metal	8	30*	15	8	5	60*	5	10	200	150*

* Longer measurement time.

Quantification and “True” Screening Well Below Regulatory Limits

Where HDXRF Wins

HDXRF also meets the tight tolerances for potentially toxic heavy metals found in the components, coatings and materials that make up electrical devices, as regulated by the EU Directive on Restriction of Hazardous Substances (RoHS).



HDXRF Level of Detection (LOD) for RoHS-Regulated Elements

LOD in ppm	Pb	Cd	Cr	Br**	Hg
Plastic Substrate	0.8	2	2	1	1
PVC Substrate	1	2	5	1	2
Coating on Plastic	5	50*	15	5	8
Metal Substrate	10	5	15	N/A	10
Coating on Metal	8	30*	15	5	10

* Longer measurement time.
** Bromine (Br) is an indicator of PBB and PBDE, RoHS-regulated compounds.

Quantification and “True” Screening Well Below Regulatory Limits

HDXRF Technical Advantages

- Ppm or sub-ppm level analysis
- Very short test time
- High precision and dynamic range
- Lab and portable analysis
- Direct testing of liquid and solid samples
- Very simple or no sample preparation
- Very low operating cost
- Simple operation: no specialist needed

HDXRF Applications

Testing for Toxic Elements in Electronics, Children's Products, Toys, Jewelry and Consumer Goods

Benchtop and Portable Units

HD Prime Analyzer

Portable Case Test Stand

HD Mobile™ Analyzer

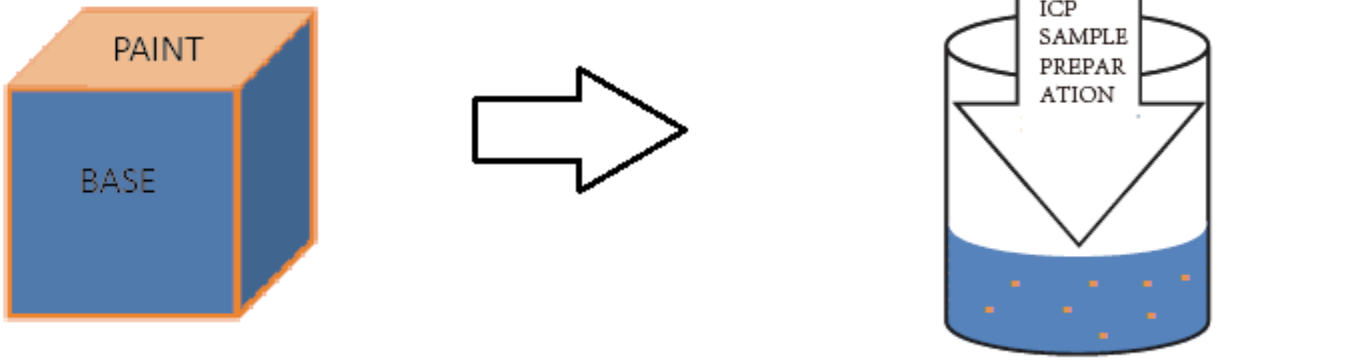
Handheld Mode

Benchtop Test Stand

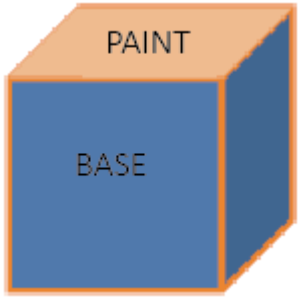
Benchtop & Portable Units

	HD Mobile	HD Mobile 101	HD Prime
Form Factor	Benchtop, Handheld, Transporter Case	Benchtop, Handheld, Transporter Case	Benchtop, very large sample chamber
CPSC Approved Method	Yes	No	Yes
ASTM Standards	F2853 F2617	F2617	F2853 F2617
Coatings	Yes	No	Yes
Key Customers	Manufacturing, Importers, Retailers, Brands	Manufacturing, Importers, Retailers, Brands	Third Party Laboratory
DCC Optics	Yes	Yes	Yes
1-mm Spot	Yes	Yes	Yes
Other	Most fully featured solution	Shorter RoHS Quantification Modes	Faster CPSC Quantification measurement from higher tube current

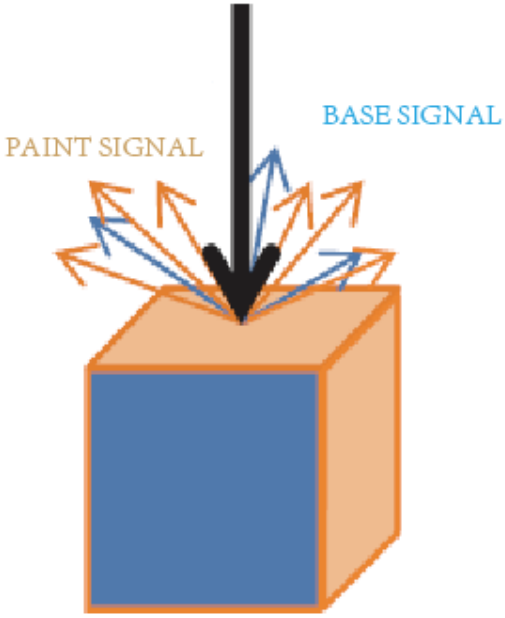
Comparing Wet Chemistry



ICP SAMPLE PREPARATION:
SOLID PART---POWDER---SOLUTION BY USING ACID

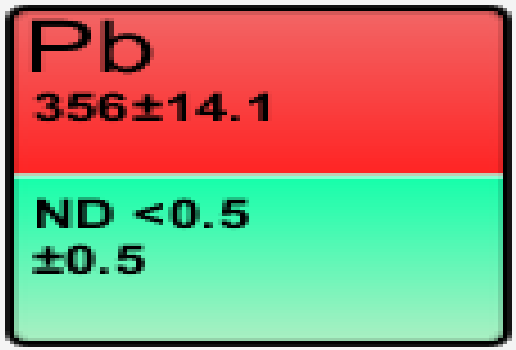


HDXRF BEAM



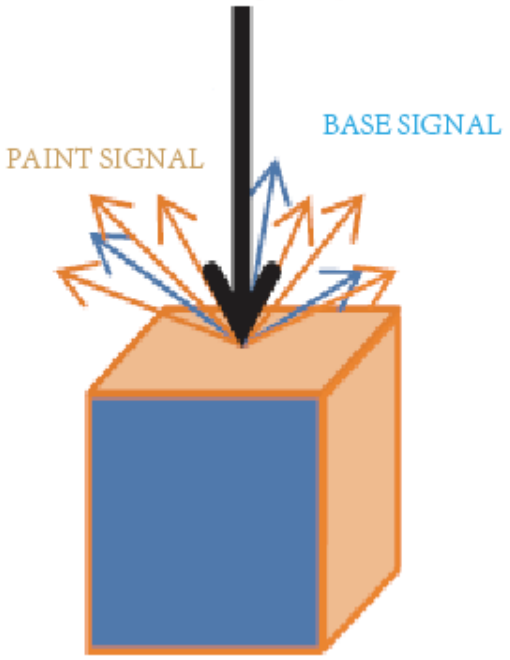
ICP shows Pass

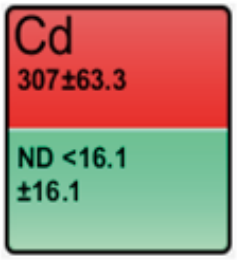
EDXRF shows RoHS Failed



XOS HDXRF results

HDXRF BEAM





REACH :
1. Cd in Paint<0.01%
2.Parts with paint, Cd<0.1%
3. Paint (with Zn inside more than 10%),Cd<0.1%

ASTM F2853:
1.Lead in paint <90ppm
2. Lead in Base<100ppm

HD Mobile Live Demo

THANK YOU