

Fast, Precise Analysis of Low Concentrations of Ti, V and Cr in Alloys

SmartBeam Technology for Critical Alloy Separations



Overview

Innov-X Systems introduces alloy analyzers featuring *SmartBeam* X-ray tube technology. With this innovative new feature, the *Inspector* – our handheld alloy analyzer – delivers unprecedented performance for low concentrations (0.05–0.5%) of Ti, V, and Cr in alloys. Using a proprietary combination of x-ray tube filtering, tube voltage and currents, the analyzer is able to provide rapid, high precision separations of alloys that only differ by small amounts of Ti or V. Recent additions include separating pure molybdenum from TZM (0.4% Ti, 0.1% Zr, bal Mo) and Lanthanum-enhanced molybdenum (1% La, bal Mo). The *SmartBeam* is an entirely automated technique – combining the ease of point-and-shoot operation with the expertise of a metallurgist.

The Application

Many industries, particularly petrochemical and power generation, specify critical alloy grades that contain low concentrations (< 0.4%) of Ti, V or other elements. Accurate identification of these alloys in the field is essential for materials control programs. Stainless steel grade 321 is common in the petrochemical industry. Low concentration of titanium (nominally 0.2–0.4%) is the main differentiator from common 304. K-Monel, containing 0.35–0.85%, is often preferred over other Monel alloys in the shipbuilding industry. More recently, low vanadium concentrations have been added to chrome/moly steels, and are used frequently in the power generation industries. One example is alloy 91, which differs from 9Cr alloy by having nominally 0.2% V versus none for 9Cr.

Innov-X has developed a handheld alloy analyzer *without radioactive isotopes*. Unlike traditional alloy analyzers that require radioactive isotopes, the Innov-X *Inspector* utilizes a rugged, miniature x-ray tube. The *Inspector* features *SmartBeam* technology, with automated filter, voltage and tube current control to fine-tune analysis quickly and confidently for even the most challenging alloys. The *SmartBeam* feature offers high precision and speed on low levels of Ti, V, Cr and other elements in alloys, without the need for radioactive isotopes.

The *SmartBeam* Method

The *Smart* software recognizes in a few seconds the alloy family (i.e. 304 or 321, or 9Cr or P91), and automatically tunes the x-ray Beam to produce a fast, high-precision measurement of the Ti, V and Cr chemistry. Precision data is shown in Table I.

The analyzer is not limited to only these alloy groups. Recent additions include TZM and Mo+La to separate from pure Mo, plus a proprietary 2¼ Cr + 0.2% V to separate from the common with 2¼ Cr alloy. Operators simply add any new alloys to the library. The *Inspector* thus provides point-and-shoot simplicity and the flexibility to ensure easy adaptation to future requirements.



The *Inspector* analyzes the toughest samples, like this AISI 321 wire, in about 10–15 seconds with good Ti precision and confident identification from AISI 304. Good Ti precision is critical to this alloy separation.

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Results

Testing data are shown for 321 and Alloy 91. Testing time is 5–7 sec with the analyzer providing both chemistry and grade – even for these demanding alloy separations. The analyzer may also be operated in a verification mode – FAST ID Mode. Testing times are even faster – typically 3 seconds. The analyzer reports grade and/or chemistry of the alloy by matching against library reference standards. *Fast ID mode is ideal for in-service PMI applications, where high surface temperatures (600F -800F) combined with small or rounded samples require tests be fast and offer high precision. Many in-service components are welds, small pipes or rounded surfaces. High precision is thus essential in these less than optimal testing geometries.*

The Innov-X *Inspector* offers an unprecedented combination of speed and precision. Our unique *SmartBeam* technology is ideal for the most challenging alloy separations – particularly in-service analysis of alloys containing low concentrations of Ti, V and/or Cr. The *Inspector* is unrivalled in this capability, being designed from the ground up with multiple tube filtering, and tube voltage and current all under software control. Ease of use is key, as the operator may use the system in a simple point-and-shoot mode to separate even the most challenging alloys automatically.

Table 1 Performance data for 321, Alloy 91 and 422.

Average result and standard deviation are shown for 20 repeat tests. Data shows the high-precision analysis for Ti and V. K-Monel (not shown) is analyzed with the same speed and precision.

Alloy 91	V	Cr	Mo
Average	.22	8.23	.93
St. Dev.	.03	0.35	.06
Cert	.192	8.24	.94
AISI 321	Ti	Cr	Ni
Average	.23	18.5	9.56
St. Dev.	.02	0.17	.30
Cert	.23	18.2	9.64
422	V	Cr	Mo
Average	.25	11.20	1.09
St. Dev.	.03	0.25	.05
Cert	.24	11.48	0.98



For more information on this application and others, or for information on the specifications or purchase of the Innov-X Portable XRF Analyzer for your materials, please contact Innov-X Systems.

