

Guide to high-performance alloys

It can be difficult and time consuming for engineers to find materials properties beyond the basic ones reported in producer data sheets. This is especially true for lesser-used high-performance alloys. The new High-Performance Alloys Database addresses this problem. It contains a large number of materials properties for each of the 100 or so featured alloys, many involving molybdenum.

The database has been developed by a spinoff of Purdue University's Research Foundation. The company's name, CINDAS LLC, derives from Purdue's former Center for Information and Numerical Data Analysis and Synthesis, which was established to provide critically evaluated materials data to engineers. The Center managed a comprehensive research program on the properties and behavior of materials. It produced handbooks and databases, gaining a worldwide reputation for high-quality data among engineers and scientists. Key data volumes included *The Thermophysical Properties of Matter* and *Aerospace Structural Metals Handbook*.

The private company has been formed to disseminate the data collected and analyzed by the Center. It is converting that data to easily accessible digital formats and is adding new information to the database. Its web-based interface (www.cindasdata.com) allows users to quickly select and compare the attributes of the alloys they are interested in. These are indispensable tools for engineers working with advanced materials.

The company recently added high-performance alloys to their offerings. The High-Performance Alloys Database (HPAD) was created to address the needs of the oil and gas, chemical processing, power and transportation industries. A survey of materials experts in these fields yielded a list of about 115 alloys to be covered. The inaugural release of the HPAD was in March 2015. It contained about 90 chapters (each chapter covers one alloy) with 10 new chapters planned each year. The HPAD has

the same interactive features as other CINDAS databases; it is web-based and continually updated. Below are some recently added molybdenum-containing alloys:

Hastelloy C-22HS (13%Mo):

An age-hardenable, corrosion resistant, nickel-base alloy that has nearly double the strength of a solid solution strengthened alloy while maintaining good ductility in the aged condition. It has high corrosion resistance in both oxidizing and reducing environments, and high resistance to chloride pitting and crevice corrosion.

Stainless steel 22Cr-13Ni-Mn (2.5%Mo):

An austenitic, nitrogen-strengthened stainless steel with very good corrosion resistance and high strength. It has better corrosion resistance than Type 316 and twice the yield strength.

Duplex Stainless steel 2205 (3.2%Mo):

This is the most widely used grade of duplex stainless steel. Its corrosion resistance lies between austenitic and super austenitic stainless steels.

Hastelloy B-3 (28%Mo):

A member of the nickel-molybdenum family with excellent resistance to hydrochloric acid. It also withstands sulfuric, acetic, formic and phosphoric acids, other non-oxidizing media, and provides excellent resistance to pitting and stress corrosion.

20Cb-3 Stainless steel (2.5%Mo):

A high-nickel fully austenitic stainless with exceptional resistance to general corrosion and stress corrosion cracking in sulfuric acid environments.

654 SMO Stainless steel (7.5%Mo):

An austenitic stainless steel that approaches the performance of some of the highly corrosion resistant nickel-base alloys at a lower cost and much higher useful strength.

Having verified technical information on these alloys readily available will undoubtedly be very useful to engineers and designers. It will help display the great properties of molybdenum-containing materials, prompting materials engineers to use them more frequently. (Curtis Kovach)



Offshore platforms constitute a harsh environment, requiring high performance alloys for many applications. © iStockphoto/Arthurpreston