Combined strength and toughness characterize new aircraft alloy

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Materials specifiers in the aerospace industry have expressed the need for an improved steel for components of landing gears, arresting hooks, catapult launch bars, and other aircraft parts that are heat treated to ultrahigh strengths. Increasingly, these aerospace users are seeking improvements to the currently used high-strength materials.

In response to the needs of several aircraft manufacturers, Carpenter Technology Corp. has developed AerMet 100 Alloy, an iron-nickel-cobalt alloy strengthened by carbon, chromium and molybdenum. Its nominal analysis: 13.4 Co, 11.1 Ni, 3.1 Cr, 1.2 Mo, 0.23 C, bal Fe. The patented alloy (No. 5087415) was designated AMS 6532 in July.

AerMet 100 is designed into the landing gear of the new carrier-based McDonnell Douglas F/A-18 E/F because of the alloy's high strength and stress-corrosion cracking resistance.

Independent laboratory tests confirm that the alloy has the highest strength and highest fracture toughness of any commercially available steel. It can be heat treated to 1930-2070 MPa (280-300 ksi) tensile strength, while exhibiting fracture toughness exceeding 110 MPa$\sqrt{m}$ at 1930 MPa (100 ksi$\sqrt{in.}$ at 280 ksi). In addition, it offers exceptional resistance to stress-corrosion cracking and fatigue compared with other steels.

Most significant, however, is the alloy's outstanding combination of properties: high strength and hardness with high fracture toughness and ductility. While AerMet 100 may not have the absolute highest strength or toughness of the steels currently used, it provides the optimal combination of these properties at unusually high levels.

Parts can be lighter, smaller

Because of its combination of properties, AerMet 100 can be used to make parts and components lighter, smaller, or tougher without sacrificing strength. Conversely, structural elements of this alloy can be made stronger without increasing weight.

The unique combination of properties also makes AerMet 100 a natural candidate for aerospace applications where 300M (UNS K44220), AF1410 (K92571), AISI 4340 (G43400), and other low-alloy steels have been used. Besides uses already mentioned, applications being considered include: fasteners, structural members, armor, actuators, ordnance, ballistic-tolerant components, jet engine shafts, drive shafts, helicopter masts, and containment rings. Non-aircraft uses would include high-strength bolts and automotive drive shafts.

McDonnell Douglas Corp., St. Louis, Mo., stimulated development of AerMet 100 when it asked CarTech for a material that would