

The structural and engineering property requirements for widespread deployment of aluminium-lithium (Al-Li) alloys in aircraft are discussed, particularly with respect to commercial transport aircraft. The development of Al-Li alloys has been driven mainly by the fact that additions of lithium to aluminium alloys lowers the density and increases the elastic modulus, thereby offering the potential of significant weight savings with respect to conventional (non-lithium containing) alloys. The first use of Al-Li alloys in aircraft goes back to the late 1950s (alloy AA 2020) and mid-1960s (alloys 1420 and 1421). These materials are referred to as the 1st generation Al-Li alloys. Subsequently there have been two major development programmes resulting in the 2nd and 3rd generation alloys. Development of the 2nd generation alloys began in the 1970s and continued through the 1980s. Attempts were made to develop families of Al-Li alloys for widespread replacement of conventional alloys. Ultimately this was unsuccessful except for "niche"™ applications. The failure to find widespread application was associated largely with the too-high lithium contents of the alloys (typically more than 2 wt%). This resulted in serious disadvantages, including mechanical property anisotropy, low short-transverse ductility and fracture toughness, and thermal instability. Development of the 3rd generation Al-Li alloys began in the late 1980s and is ongoing. These alloys have significantly reduced lithium contents (0.75 " 1.8 wt%) and there are other important compositional changes. Silver and zinc have been added for strength, and zinc improves the corrosion resistance; and manganese is added besides zirconium, which was already present in 2nd generation alloys, to control recrystallization and texture. These differences and improved knowledge about thermomechanical processing and heat-treatment have resulted in a family of alloys with significant property advantages covering all major structural areas and applications for transport aircraft.

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