High Entropy Alloys (HEAs) are a new type of near equiatomic multi-component alloy systems that are typically composed of 5 or more alloying metals, which, contrary to expectations, can have simple phase structures. This offers the materials scientist exciting new opportunities to design alloys with new or superior properties to traditional alloys, for example possessing increased wear and corrosion resistance compared to traditional metals, whilst satisfying requirements for heat transfer and lower weight.

Researchers in Sheffield have investigated a number of new alloys for various applications. Amongst the suite of new alloys with properties that may be desirable for automotive applications, the CoCrFeNi-Al alloy family has shown comparable hardness and yield strengths to martensitic steel, which can be achieved by tuning the stoichiometry. Another advantage of HEAs is that the thermal stability of its main phase renders it relatively insensitive to production conditions, reducing production costs by allowing larger tolerances for cooling rate and heat treatments in production.

Fine tuning of alloys may allow for hitherto impossible combinations of high strength combined with good heat transfer properties and lower density. Such new alloys may find use in internal combustion engines, for example in the engine valve train, where new alloys may be able to combine both high strength and hardness and low density to help reduce the overall weight of the engine.

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