News Release

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SANYO SPECIAL STEEL

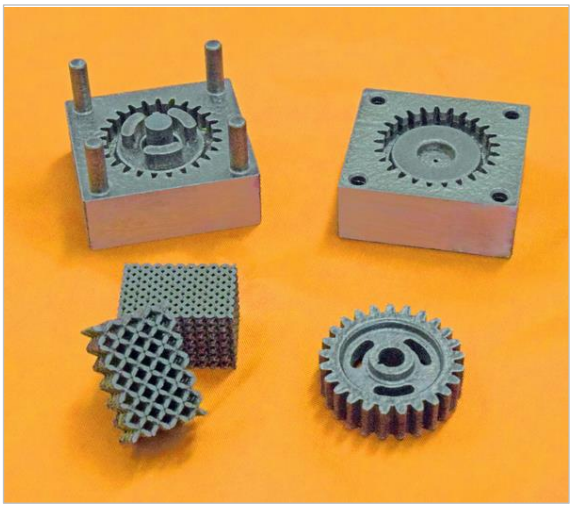
Commercialization of a Cobalt-free Maraging Steel Powder for Additive Manufacturing

- Achieving high strength and high toughness comparable to that of conventional maraging steel, without the addition of cobalt -

Sanyo Special Steel Co., Ltd. has developed and brought to market a new maraging steel powder for additive manufacturing, which does not use cobalt (a Specified Chemical Substance in Japan).

Maraging steel is used in a wide variety of fields including industrial machinery, automotive, and aerospace, as it combines both high strength and high toughness through heat treatment. Although it is also widely used to make molds by additive manufacturing, health protection measures such as installation of dust eliminators are required for additive manufacturing using maraging steel powder with particle sizes of approximately 100 μm, because maraging steel contains cobalt, a Specified Chemical Substance.

Our new maraging steel powder for additive manufacturing achieves high strength and high toughness comparable to that of conventional maraging steel, without the addition of cobalt. This eliminates the need for health protection measures, making it easy to apply in the additive manufacturing of molds and components which used to use maraging steel for their required high strength and high toughness.



【Examples of moldings by additive manufacturing】

■ Development Background

Maraging steel is used in a wide variety of fields including industrial machinery, automotive, and aerospace, as it combines both high strength and high toughness. Generally, materials with high strength (hardness) are prone to developing cracks and other defects during additive manufacturing. Since maraging steel is strengthened through heat treatment, it is widely used in molds as a material suitable for additive manufacturing, because it has low hardness during additive manufacturing, making it resistant against developing cracks and other defects.

However, since maraging steel contains a certain percentage of cobalt (Co), which is a Specified Chemical Substance in Japan, manufacturing processes using maraging steel powder as a material are required by the Ordinance on Prevention of Dangers Due to Specified Chemical Substances (Japan) to provide health protection measures such as dust eliminators, etc. Also, cobalt is a rare metal with a high procurement risk due to extremely uneven distribution of resource areas and international issues around its mining in politically unstable regions. This led to demand for a powder for additive manufacturing that could achieve the superior properties of maraging steel, without the use of cobalt.

■ Key Points of Development

Maraging steel goes through two types of heat treatment—solution treatment and aging—to increase its strength through the precipitation of intermetallic compounds within the matrix. Reducing the amount of cobalt contained in maraging steel leads to reduced strength, as its function is to promote the precipitation of intermetallic compounds within the matrix. Furthermore, there is also the issue of reducing the amount of cobalt leading to a loss of toughness, as cobalt also has the effect of inhibiting the generation of brittle phase during aging treatment.

To address this, using our unique alloy design and structure control technology, we have discovered an alloy composition that achieves the required strength through promoting the precipitation of intermetallic compounds without the addition of cobalt. In addition to this, we established heat treatment conditions that inhibit generation of brittle phase. As a result, we have developed a new metal powder for additive manufacturing that can achieve the same high strength and high toughness as conventional maraging steel without cobalt.

Mechanical Properties after Aging

	Hardness (HRC)	Tensile Strength (MPa)	Charpy Impact Value (J/cm^2)
Developed material (moldings by additive manufacturing)	**53**	**1850**	**29.9**
Conventional maraging steel (18-Ni 300 Grade/casting material)	51 to 55	1820 to 2100	20.3 to 32.2

■ Benefits

Our new maraging steel powder achieves high strength and high toughness comparable to that of conventional maraging steel, without the addition of cobalt, which is a Specified Chemical Substance. This eliminates the need for providing health protection measures during additive manufacturing, making it easy to apply in the additive manufacturing of molds and components that require high strength and high toughness.

We are actively working to provide total support for our customers' development, along with providing ideal metal powders for additive manufacturing through the development of alloy compositions, establishing manufacturing processes that maximize material properties, and utilizing rapid material evaluation systems. We will continue to focus our efforts on developing new products and technologies, providing solutions that utilize materials and technology in order to improve the competitiveness of our customers.

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