

銅熔滲製程對粉末冶金件正齒輪精度之影響

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摘 要

齒輪為機械傳統系統中非常重要的元件。工業界廣泛使用的金屬材質齒輪的製造方法，大致可分為切削法與非切削法。粉末冶金法製造齒輪屬於非切削法，具有省材料、省製程、低成本及高尺寸精度等優點。另外，粉末冶金法隨著材料科技的發展，技術層次日新月異，大幅地提昇了粉末冶金齒輪的機械性質，使得粉末冶金齒輪之市場擴展迅速。

粉末冶金齒輪的精度和其所使用之原料粉、成形過程與燒結方法等息息相關。而粉末變化率、生胚密度、模具設計、燒結時間與燒結溫度等因素都會造成粉末冶金齒輪之齒面產生幾何形狀誤差，並因此導致齒輪在嚙合運轉時產生運動誤差，以及引起齒輪之振動與噪音。為了降低齒輪之傳動誤差、改善齒輪的振動及噪音，提高齒輪製造精度乃是首要之務。

本論文將採用實際上粉末冶金齒輪的製程條件，配合田口實驗法來進行試作實驗與齒輪精度的量測，以探討銅熔滲之製程參數對粉末冶金正齒輪精度之影響，以期能提供粉末冶金正齒輪生產時製程參數調整的參考依據，進而提升粉末冶金正齒輪製造之精度。

Effects of Infiltration Process on the Profile Precision of a Powder Metallurgy Spur Gear

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Abstract

The gear is a very important element in a transmission system and machinery. The manufacture methods of gears can be categorized into the cutting method and the non-cutting method. Manufacturing of a sintered powder-metallurgy gear belongs to the non-cutting method. The sintered powder-metallurgy gears have great advantages of material-saving, labor-saving, cost down and accurate in dimensions, etc. Besides, the powder-metallurgy manufacturing technology changes with each passing day because of the development of materials science, improves the mechanical properties of the powder-metallurgy gears. It enables the market of the powder-metallurgy gears to expand rapidly.

The precision of the powder-metallurgy gears is related as closely with the powder, forming and sintering process. Powder variation, green density, sintering temperature, sintering time and the design of a forming die are the factors not only affected on gear surface deviations, but also caused the gear transmission errors, vibration and noise during the gear pair meshing. Therefore, it is most important to improve the gear manufacture precision to reduce the gear transmission errors, vibration and noise. To obtain a high precision gear, the control of gear dimensions and variations is important.

This study refers to the conditions of a practical powder-metallurgy manufacture process, and proceeds to experiments and gear precision measurements by using Taguchi methods as well as investigation on the effects of infiltration process on gear precision. This provides important information for amendments on the parameters of the powder-metallurgy spur gears manufacture process, and then to improve the gear manufacture precision.