
金刚石粒径和分散工艺对复合镀层的影响

摘要

Ni-P 金刚石化学复合镀层有着优异的耐磨、耐蚀、高硬度性能，因此得到了工业界各行各业的广泛关注，Ni-P 金刚石化学复合镀研究也已经成为了当前的一个热点方向。随着对其研究的不断深入，它的形成机理、工艺参数和条件的控制、镀层性能更加明了。与此同时，Ni-P 金刚石化学复合镀也有一些问题亟待研究解决。

本文在查阅了 Ni-P 金刚石复合镀的历史起源和发展现状、形成机理、工艺进展和应用范围的基础上，利用耐磨、硬度、耐蚀的表征手段结合图表和文字，分析总结并评论了金刚石粒径对镀层表面形貌、镀层金刚石含量、显微硬度摩擦磨损性能等四方面影响；总结了超声搅拌的优缺点介绍了气体搅拌和镀液循环搅拌；阐述了主盐硫酸镍、还原剂次亚磷酸钠、增强相金刚石、施镀温度、PH、搅拌转速这六个因素各自对镀层的影响；探索了 Ni-P 金刚石复合镀层研究前景和发展趋势，指出了 Ni-P 金刚石复合镀今后的研究与发展方向。

根据总结分析发现，纳米金刚石作为增强相制备的 Ni-P 复合镀层要比微米金刚石的组织更加均匀致密；同样质量的金刚石，纳米级金刚石沉积到镀层的数量要比微米级的更多；在适度范围内，金刚石粒径越大其对应的复合镀层显微硬度和耐磨性也就更好；本文还在总结超声搅拌工艺的优缺点的基础上，提出了改进型的分散工艺方法：气体搅拌和镀液循环搅拌；此外，还指出了纳米金刚石灰粉存在杂质的问题，并且提出了给金刚石包裹亲水性金属氧化层的方法来改进金刚石的预处理。最后，还给出了最优的工艺参数范围：主盐硫酸镍浓度应保持在 30g/L 附近、还原剂次亚磷酸镍浓度应保持在 28g/L 左右、金刚石浓度应该在 10g/L 上下、施镀温度应在 80-85℃ 之间、PH 应该保持在 5-5.5 之间、搅拌速度为 500r/min。

关键词：化学镀；化学复合镀；纳米颗粒；分散；显微硬度；耐磨性

Abstract

The Ni-P diamond chemical composite coating has excellent wear resistance, corrosion resistance and high hardness properties, so it has received wide attention from all walks of life, the study of Ni-P diamond electroless composite plating has become a hot topic. With the further research, the formation mechanism, process parameters and conditions control, coating properties become more clear. At the same time, there are some problems to be solved in Ni-P diamond electroless composite plating. On the basis of reviewing the historical origin and development status, formation mechanism, technological progress and application scope of Ni-P diamond composite plating, the author combined the charts and characters with the characterization methods of wear resistance, hardness and corrosion resistance, the effects of diamond particle size on the surface morphology, diamond content and micro-hardness, friction and wear properties of the coating were analyzed and reviewed. The effects of the main factors such as nickel sulfate, reducing agent Sodium hypophosphite, strengthening phase diamond, plating temperature, pH and stirring speed on the coating are described, the future research and development of Ni-P composite plating of diamond are pointed out. It is found that the Ni-P composite coating prepared by using nano-diamond as reinforcing phase is more uniform and compact than that of micro-diamond, the amount of nano-diamond deposited into the coating is more than that of micro-diamond, and the larger the diameter of diamond is, the better the hardness and wear resistance of the composite coating are. On the basis of summarizing the advantages and disadvantages of the ultrasonic stirring process, the improved dispersion process, namely, gas stirring and circulating stirring of the plating solution, is put forward, the method of coating hydrophilic metal oxide layer on diamond was proposed to improve the pretreatment of diamond. And finally, the optimum

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