RESIN BONDED CARBON RING FOR MECHANICAL COMPONENTS

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Introduction

The use of carbon materials in mechanical components such as bearings, seals, and bushings that do not require lubricants is increasing rapidly.

This paper reports on establishing the best mixture of materials for bushings. We fixed the optimal content ratio of materials, which include graphite powder and diatomite as a lubricant modifier and a friction modifier, respectably, with resin used as a bonding material. We then produced bushings using hot-pressing within the temperature range of resin curing. Finally, the properties of resin bonded bushings, the friction coefficient, wear rate, correlation of friction coefficient and sliding distance, and the mechanical strengths are discussed in relation to the content of respective materials.

Experimental

Combinations of graphite, diatomite, and resin were mixed using methanol and hot-pressed using the temperature schedule consistent with the thermal-gravity curve of resin. We examined mechanical properties, wear rate, and micro structure after the wear test were performed.

Results and Discussion

Considering the workability of the resin and the mechanical strength of bushings, the optimal content of resin was evaluated by changing 5wt% range from 25wt% to 50wt%, with a fixed 10wt% of graphite powder. The bending strength and hardness were found to increase with increased resin content. In conclusion, based on the wear test by Pin-on-Disc, no noise was found with the steel disc within the hardness range of 60 when the resin content was 40%. Bending strength was also good results at that content.

The graphite powder content was determined by changing within 60wt% graphite powder and diatomite, respectively, with a fixed resin content of 40wt%. The mechanical strength was found to decrease gradually as we increased the content of graphite powder. This is attributed to the poor wettablility and plasticity of graphite. It should be noted, however, that the mechanical strength decreased rapidly when the percentage of graphite powder was 30% or more.

Fig.1 shows the friction coefficient changes as we increased the content of graphite powder. The friction coefficient decreased steadily as we increased the graphite powder content up to 30wt%, reversing at that point and showing an equally steady increase from that point on. This demonstrated the influence on mechanical properties caused by an excessive percentage of graphite powder.

Fig.2 shows the wear rate and hardness relative to the percentage of graphite powder. Increasing wear rate with increased graphite powder were consistent with decreasing hardness rates.

The results of extensive studies on graphite content and its relationship to friction and sliding-distance are shown in fig.3. The friction coefficient increased rapidly at the starting step of the friction test, but it stabilized thereafter. At a graphite content of 10wt%, however, an unstable friction aspect was found. The same unstable aspect was also found at the 50wt% content level. Both findings are related to the graphite content. A 10wt% graphite content is too low to form a lubricant surface on the bushing, while a graphite content of 50wt% is too high. This is shown by the scanning electron micrographs of bushings. The photographs of graphite 20wt% shows an aspect of lubricant surface on the entire cross-section of bushing.

Conclusions

The bushing prepared with the optimal content of graphite powder, resin and diatomite resulted in a low friction coefficient and wear rate and good mechanical properties as compared to bushings for same purpose made with resin bonded carbon without diatomite.

Acknowledgments

The financial support of the KOMEX CARBON Corp. is highly appreciated.

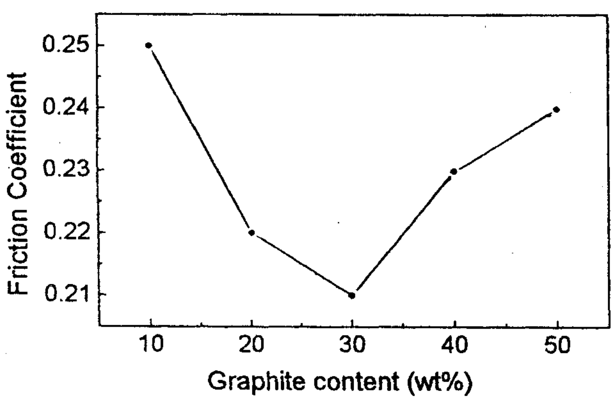

Fig. 1 Friction coefficient of bushing according to graphite-diatomite content (graphite+diatomite=60wt%)

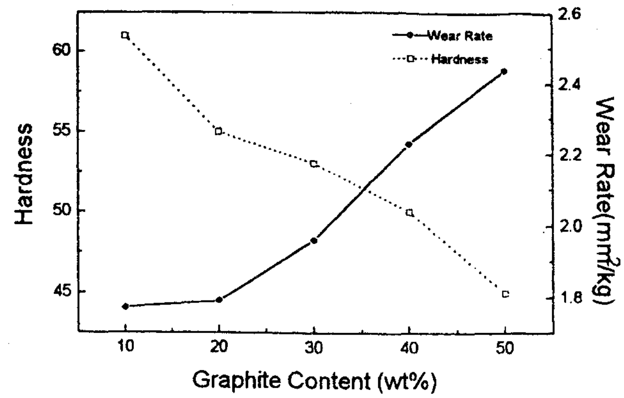

Fig. 2 Hardness and wear rate of bushing according to graphite content

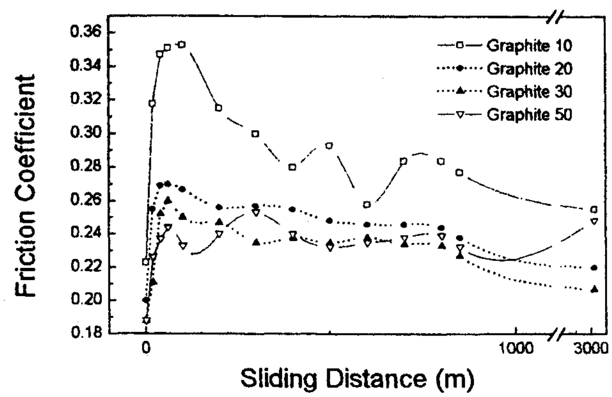

Fig. 3 Correlation of friction coefficient and sliding distance of bushing according to graphite content

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