Hoechst Technical Polymers to Gather Plastic Gear Materials Data

Hoechst Technical Polymers has expanded its interests in plastic gears with the introduction of the new Plastic Gear Evaluation and Research machine P-GEAR™ The machine is the centerpiece of the company's continuing efforts to promote and develop the use of plastic gears in higher-powered applications.

Other efforts include the development of new grades of plastics for gear manufacturing use, a special company team devoted to plastic gear research, the support of university-based research into the uses of plastics for gears and the future publication of a plastic gear design manual.

Plastic Gear Advantages

Plastic gears have some advantages over metal parts in some applications. Used as-molded, they do not require expensive finishing operations. They can cost as much as one-half to one-fourth as much as stamped, machined or powder metal gears, and they can weigh as much as 75% less. They can be self-lubricating and can run quieter than metal gears one or two AGMA quality classes higher in accuracy. However, one powerful drag on the increasing use of plastic gears in industrial applications has been the lack of available engineering data. "We can't get people to use our materials without having the data to enable designers to assess how the materials will work in their applications," says Maribeth Fletcher, leader of the HTP Gear Team.

The P-Gear Tester

The P-Gear Tester, built by Lewis Research, Inc. of Lewes, DE, is part of the answer to that problem. It is a computer-controlled wear and fatigue tester that should provide much useful data about the gear working environment and the way plastics behave in it.

The tester enables researchers to test plastic gears in a range of conditions, with and without lubrication, and to collect data automatically. It has a precision dynamometer and drive to run gear sets of mixed materials under loads of 5.5 hp and at speeds to 3,600 rpm. Gear set center distances can range up to 5", and parallel shaft gear sets can include a third idler gear. The drive assembly also swings 90° to accommodate worm gears and other cross-action drives. P-GEAR provides ambient environments from room temperature to +200°C initially and will go down to -40°C with future modification.

System Strengths

The system uses a Pentium®-based PC with Strawberry Tree™ data collection software. It uses precision rotary encoders to monitor the relative position of meshing drive and driven gears under programmed loads. Gears run at constant speed and torque for a set period and are then stopped and oscillated slowly to measure their relative positions in order to assess backlash.

P-GEAR has non-contact infrared temperature sensors for unlubricated gears and fluid temperature sensors for lubricated gears. According to Hoechst, temperature measurements taken on different materials at changing loads and speeds will provide researchers their first accurate picture of the gear tooth environment, leading to predictive measurement of tooth temperature and ultimately to the selection of the best candidate gear material for each specific design and application.

Researchers also hope the P-GEAR tester will enable them to run static bending tests to measure mesh stiffness. It will also monitor gear noise and document the effect of material mixes and resin additives on noise reduction.

P-GEAR's data collection capability will allow the machine to chart the gear environment and help generate predictive equations for estimating the fatigue life of plastic gears.

Initially the tester will be used to validate existing data on HTP resins in plastic gears. These preliminary measurements on familiar materials will help formulate test protocols for developing gear life cycle curves related to bending strength and contact stress and wear. Subsequent work will establish protocols for predicting tooth operating temperature and provide wear constants for predictive life cycle equations. ○

HTP's P-GEAR™ plastic gear tester.

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