

While this concentration does little to alter the fluid flow and viscous shear behavior, it is more than adequate to lower the adhesive forces greatly. The change of torque was immediately apparent on the next clutch application and was repeatable thereafter. The shaded area of Fig. 14 should be indicative of the relative amount of mechanical contact during the clutch application, since this is the result of a change primarily to the adhesive component of friction.

SUMMARY AND CONCLUSIONS

A simple model of the engagement process has been conceived for wet friction materials, especially those with porous paper surfaces. The model consists of three phases: a time-dependent hydrodynamic squeeze film phase where no mechanical contact is made and torque is generated through viscous shear alone; a time- and velocity-dependent squash film phase where intermittent rubbing of asperities generates some adhesive friction, produces additional hydrodynamic action, and provides local cooling; an adhesive contact phase where hydrodynamic effects are minimal and where physical and chemical reaction surface films largely control the friction.

In support of the model, laboratory test results were presented of paper clutch squeeze/squash film behavior in a new laboratory test fixture. Also SEM photographs, profilometer data, and clutch inertia dynamometer friction and wear results were discussed in the context of the new engagement model.

While no incontrovertible conclusions may be reached at this time about the validity of the model, it has proven to be useful in understanding inconsistencies of test results from different test machines. Both the model and the squeeze film fixture have aided in diagnostic investigations.

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Society of Automotive Engineers, Inc.
Two Pennsylvania Plaza, New York, N.Y. 10001

12 page booklet.

Printed in U.S.A.

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