

Current lubrication research in Hungary

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Lubrication science (i.e., tribology) is alive and well in Hungary. This small country in central Europe really typifies the term 'downsizing'. Having been reduced in size following both World War I and II, Magyarország (Hungary) fits easily into the map of Michigan. However, this geographical shrinkage may have been an advantage for its slightly more than 10 million inhabitants who are primarily one ethnic group (i.e., Hungarians), a virtue not shared by most of its neighbours. This fact may have contributed to the minimal amount of political strife following the downfall of the Marxist regime.

In addition, Hungary had a head start into the market economy, with either a push or a blind eye from the Brezhnev regime in Moscow. So gradually, for the last 10 years, the Hungarians have been weaning themselves away from the planned Marxist philosophy that had placed such a stranglehold on the economies of Eastern Europe.

Fortunately, and in spite of the division of industrial labour directed by Moscow (Poland, Czechoslovakia and Romania were permitted to produce passenger cars), Hungary maintained manufacturing skills with the production of Icarus, one of Europe's premium buses. With the recent advent of democratic capitalism (1990), there has been a rash of joint ventures as well as investment capital into new manufacturing and the opening of branches of well-known US companies. In incandescent lamp manufacture, Tungram of Hungary is now partners with General Electric, CSEPEL of Hungary builds bicycles with Schwinn on an island in the Danube, and General Motors is constructing an assembly plant for the Opel currently manufactured in Germany. In addition, we understand that Gen-

eral Motors is planning for an engine plant in the near future. Food industry cooperation is also evident. A branch of Sara Lee is thriving, as are Burger King and MacDonalds. AFOR, the once state monopoly for automotive fuels and lubricants, now has competition in some form from AGIP, Shell and BP.

During the communist presence, lubrication research had been carried out in two arenas: the government-controlled 'Oil and Gas Trust' (Országos Koolaj és Gazipari Troszt), and in appropriate departments in several universities and polytechnic schools. Within the Oil and Gas Trust, which currently employs some 45 000 individuals, the Hydrocarbon Research Institute holds primary responsibility for all problems related to lubricants. Bear in mind that during the previous regime, most lubricant needs had to be solved domestically because of the shortage of hard currency. Thus, importation of readily available materials from the West was, more often than not, impossible. In spite of these limitations, Hungarians have carried out an active research programme in tribology and the related field of corrosion science. They have made continual contributions to the Esslingen conferences and in 1989 were hosts for a symposium on synthetic lubricants.

Notable in that conference are publications by Deak *et al.*¹, on synthetic oils from waste polyolefins. Gyula Deak, from the Department of Chemical Engineering of Veszprem University, one of the universities involved in tribology research, has continued his studies on the utilization of thermally degraded poly-alpha-olefins. In this last publication, he and his co-workers have evaluated these later products as starting materials for synthesizing alkenyl succinic esters and alkyl benzene derivatives.

Kovacs and Olajos², from the Hydrocarbon Institute, have looked at the

use of synthetic 2T engine oil as a tool for exhaust emission control for two-stroke engines. At the time of the research, the problem with two-stroke cycle engine emissions was serious in Eastern Europe because of the DDR (East German) Trabant. With the unification of Germany, the Trabant is being phased out. Another contribution from Veszprem University by Nemes *et al.*³, is a comparative study of synthetic and semi-synthetic automotive lubricants. This study was done in collaboration with colleagues from the Hydrocarbon Institute.

These three papers are indicative of the type of research in tribology in Hungary focusing on recycling and emissions control. In the more recent conference on Microbiology in the Oil Industry and Lubrication held in Sopron, Hungary, 10–12 September 1991 (Fig 1), where the official language was English, the focus was on bio-deterioration and biodegradation of lubricants, including metal-working fluids (MWF), especially as they impact on the environment.

Horvath, *et al.*⁴, representing the Universities of Budapest and Miskolc and the government roller bearing works in Debrecen, dealt with microbial-influenced corrosion (MIC) resulting from contamination of MWF in bearing manufacture. Their discussions of origins were right on target, although we would take exception to their presentations of biocide data. They evaluated eight biocides, all but one listed as trade names. Not only do we in STLE frown on the commercialism of trade names, but especially in the international arena, obtaining the actual chemistry of the biocides, although very important, is extremely difficult. The Hungarians cannot be faulted for this since the regulatory controls and mandatory disclosures in the US are not operative in many European countries, including Hungary and especially in countries exporting to Hungary. In addition,

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Table 1 Base oils

Base oils are solvent refined, dewaxed and hydrofinished medium, heavy and residual oil fractions

Quality characteristics

Designation	SAE 10/95	SAE 20/90	SAE 30/90	SAE 40/80	SAE 50/80	SAE 50/93	Bright stock
Viscosity at 50°C, mm ² s ⁻¹	17-22	29-41	52-75	85-105	-	-	-
Viscosity at 100°C, mm ² s ⁻¹	-	-	-	13-16	20-23	min. 18	min. 26
Viscosity index, min.	95	90	90	80	80	93	80
Flash point, open c., °C, min.	210	215	220	225	230	230	260
Solidification point, °C, max.	-15	-15	-15	-15	-15	-10	-10
Acidity, mg KOH g ⁻¹ max.	0.05	0.05	0.05	0.05	0.1	0.1	0.1
Conradson number, wt %, max.	0.05	0.10	0.2	0.45	0.5	0.4	1.0
Ash content, wt %, max.	0.005	0.01	0.01	0.01	0.01	0.01	0.01
Sulphur content, wt %, max.	0.5	-	1.0	-	-	-	-
Colour, ASTM, max.	2.5	3.5	3.5	4.5	5.0	5.0	6.0

Marketed by Mineralimplex



Fig 1 Dr Katalin Rossmoore in front of the Sopron Hotel, the site of the conference

Table 2 Lubricants for cold metal forming

EMADO-Dd	For deep drawing of metal sheets e.g. steel, aluminium, copper and brass
EMADO-SD	For deep drawing of stainless steel sheets
EMADO-TD	For drawing of copper tubes and copper, and brass rods
EMADO-PD	For drawing of fine brass tubes
EMADO-STD	For drawing of stainless steel tubes with fine diameters
EMADO-CRS	For drawing of steel and stainless steel rods
EMADO-WD	For drawing of aluminium wires
EMADO-AP	For punching and deep drawing of aluminium sheets

Developed and produced by the Hungarian Hydrocarbon Institute

the only biocide identified chemically was formaldehyde. This issue of formaldehyde is another area which OSHA concerns would not permit in the USA and where such restrictions currently do not exist in Hungary. From our conversations with responsible individuals in lubrication, we would expect that the problems mentioned above will not be repeated in the future.

Bobest *et al.*⁵, of the Komárom Refinery, produced a contribution on the development of environmentally friendly lubricants. Biodegradability, acute and chronic toxicity, as well as environmental impact on aquatic lifeforms, were evaluated and compared with the functional qualities of the lubricants. Two papers specifically focused on environmental concerns. Toth and Kallo⁶, of the Hydrocarbon Institute, stressed that new environmental protection requirements demanded more attention to biodegradability of lubricants which impact directly on the environment. They evaluated chainsaw lubricants for both biodegradability and functionality and developed a

product that could be successfully used by the forestry industry. Szabo *et al.*⁷, from the Hungarian Hygiene Institute, examined the composting of oil wastes containing polynuclear aromatic hydrocarbons (PAH) as a means of reducing toxicity. After 20 weeks, a significant reduction of PAH was produced. This is an area under investigation in the USA under the heading of bioremediation.

Currently, the Oil and Gas Trust is responsible for a variety of products, including base oils marketed by Mineralimpex (Table 1), lubricants for metal forming (Table 2, Fig 2), and the retail outlets AFOR which control the service stations marketing automotive lubricants under that name (Fig 3).

The Hungarian Hydrocarbon Institute (Magyar Szenhidrogenipari Kutató-Fejlesztő Intézet) located in Szazhalombatta, a suburb of Budapest, is the R&D arm of the Oil and Gas Trust (Figs 4 and 5). It is responsible for lubricant basic and applied research which includes technical service, development of products and instruments, experimental product manufacturing, environmental protection, and interaction in all

areas with foreign trading partners. For operational purposes and especially as the Institute relates to the Oil and Gas Trust, activities are referred to as 'upstream' and 'downstream.' The former deals with oil production and mining lubricants, while the latter deals with refinery technologies, petrochemicals, corrosion prevention, biocides and environmental protection.

The activity of the Institute in the field of lubricant development is closely interconnected with the

research work of lubricant manufacturers, the aim of which is to develop product choices suitable for Hungarian technology (e.g. Inaktol cutting oil, NIRAL rolling oils, hydraulic oils, HIXOL gear oils, Alukomplex lubricating greases, DS-3, DS-5 motor oils, etc). Significant results have been achieved in the development of functional products for metalworking. The EMADO product family, consisting of more than 10 members, is manufactured in the institute based on the needs of the machine tool industry. In addition, multipurpose protective lubricating oils have been developed for the lubrication and corrosion protection of periodically operating vehicles. These are manufactured in the Danube Refinery (e.g., HIXOL RP, EKT-90).

The Institute employs some 900 people, including technicians, engineers and scientists. During our visit to the Institute, we had the good fortune to be hosted by Dr Gyula Gáti, Deputy Director and Scientific Manager of the Institute, and Dr Andras Zakar who is responsible for tribology R&D (Fig 6). According to Dr Gáti, the coming year will see profound changes in the structure of the Institute with reorganizations the order of the day. These changes are intimately related to the changing political scene and the goals include joint venture possibilities with foreign investors as well as interaction with Hungarian companies which have been privatized. The wave of the future is profit, with the Hungarian National Hydrocarbon Co the cost centre for research and



Fig 3 AFOR display at the commercial exhibition at the Sopron conference

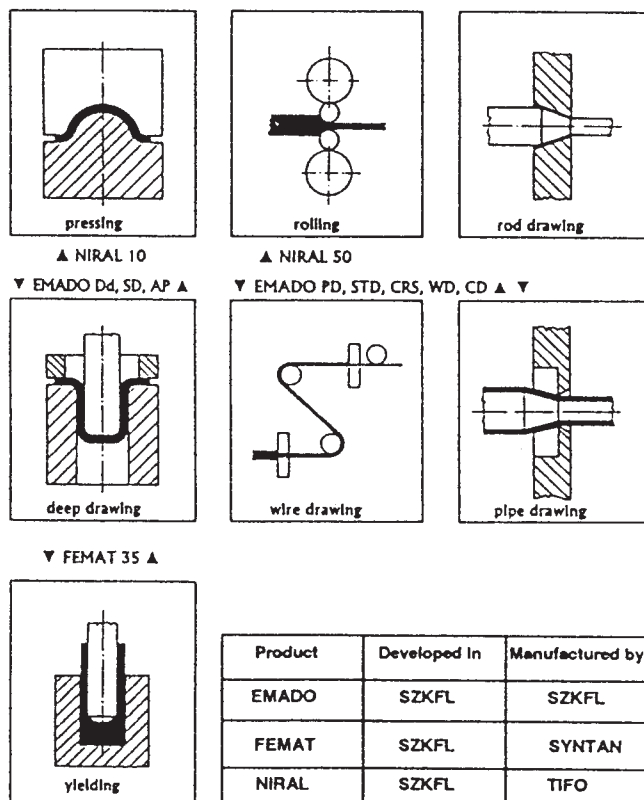


Fig 2 Field of application for the cold metal working lubricants developed in the Institute

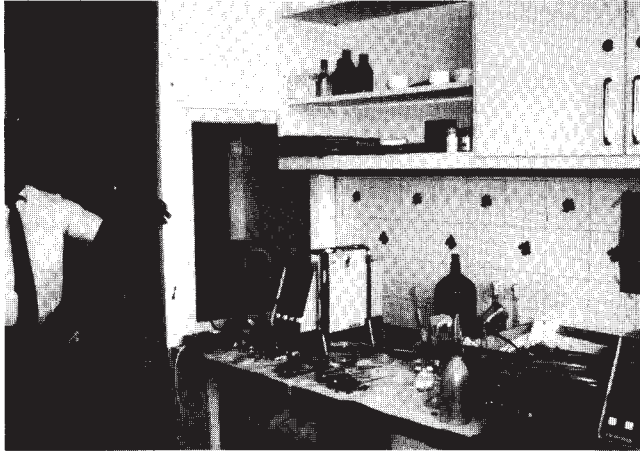


Fig 4 Environmental Chemistry Laboratory, Hydrocarbon Research Institute

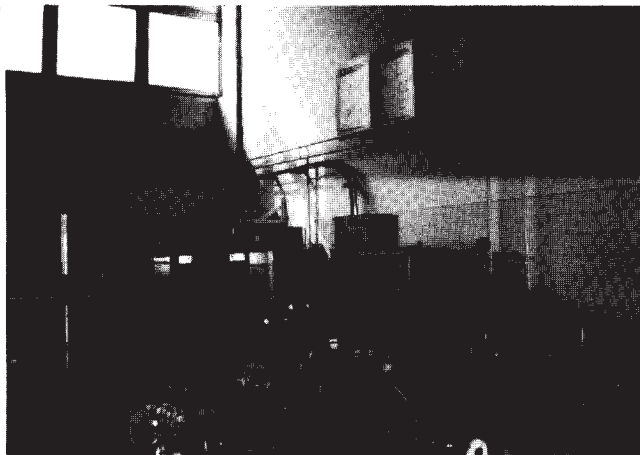


Fig 5 One of the tribology research and testing laboratories, Hydrocarbon Research Institute

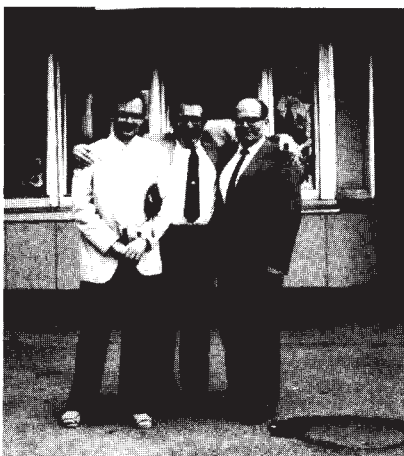


Fig 6 From left to right: Drs Zakar, Rossmoore and Gáti

development. Hungary has made a commitment to democratic capitalism and alignment with Western Europe.

The 'American dream is alive and well in East Europe,' to quote a headline in *Lubricants World*⁸. At the Independent Lubrication Manufacturers Association (ILMA) meeting held in 1991 in Orlando, Florida, two speakers emphasized the demand for many industrial products, including lubricants, the need for investment, and the availability of highly skilled Hungarian labour. We can add to this the expected convertibility of the Hungarian Forint to hard currency in 1992.

Thus, we are sure there is ample opportunity to interact with Hungarian tribologists. One more indication of the determination of the

Hungarians to continue in their pursuit of excellence in lubrication research is their hosting of the 6th International Congress on Tribology, EUROTRIB '93 BUDAPEST, scheduled for 30 August–2 September 1993 in Budapest, Hungary. As a member of the international steering committee, H. W. Rossmoore will be pleased to give additional information upon request.

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