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FEODOR FEODOROVICH VITMAN, IN MEMORIAM

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NOVEMBER 29, 1967, was the sixtieth anniversary of the birth of the great Soviet scientist, Doctor of Physicomathematical Sciences, Professor Feodor Feodorovich Vitman.

Vitman's scientific activity began in 1928, while still a student of the physico-mechanical department of the Leningrad Polytechnic Institute, when he was invited by N. N. Davidenkov to work at the state physico-technical institute (now the A. F. Ioffe Physico-technical Institute (FTI), USSR Academy of sciences). Already in 1932 Vitman was placed in charge of the FTI laboratory and guided the scientific work of the staff of this laboratory to his death, that is, for thirty-five years.

During these years, Vitman and those working under his guidance performed and published more than 150 investigations, including several monographs and textbooks[1-3]. Vitman's work was a major contribution to Soviet science. It represents an example of the solution of complicated physical problems and at the same time contributed and still contributes to the solution of important practical problems.

With respect to the subject matter, the research performed by Vitman can be subdivided, with a considerable degree of arbitrariness, into three cycles.

I. STUDY OF THE COLD BRITTLENESS OF METALS

The main investigations of this cycle[4-14] pertain to the decade before the war.

Cold brittleness, i.e., brittleness of steels and many other metals, becomes manifest under certain definite physical conditions. Vitman investigated in detail the tendency to brittle fracture as a function of the surface quality of the article, the prior case hardening, and the rate of loading. As a result of precision experiments he established that all the factors contributing to the increase of the yield point and the surface layer, which increase the tendency of the material to the generation of cracks, or, finally, which produces a stress concentration, increase the critical brittleness temperature.

The most complicated problem was that of the influence exerted on the brittleness temperature by the rate of deformation. The existing methods did not make it possible to cover a sufficiently broad rate interval. Vitman was cleverly able to get around the methodological difficulties, increase appreciably the impact velocity, and to solve this problem reliably. It was shown for the first time that the critical temperature of the brittleness and the rate of deformation are connected by an exponential relation. It was established at the same time that the yield point is a power-law function of the rate of deformation. These results, which are of fundamental significance, were soon universally recognized and served as a basis for the solution of practical problems.

Also pertaining to the discussed cycle are Vitman's work on the study of the tendency of steel to brittle fracture as a function of the dimension of the sample and the type of distressed state. The results of these investigations, confirmed experimentally for the first time the statistical theory of brittle damage.

It is impossible to overestimate the significance of the investigations performed by Vitman. They have made it possible to discover the mechanism of the phenomenon and at the same time pointed the way towards increasing the reliability of the service life of metallic articles. Such investigations were performed abroad only many years later.

II. STUDY OF THE BEHAVIOR OF SOLIDS AT HIGH LOADING RATES

This cycle of investigations[15-23] was undertaken by Vitman immediately after the end of the war.

The question of the laws governing the deformation and damage of plastic and brittle bodies in a wide range of loading rates, and especially at low application times, is one of the cardinal problems of the physics of strength. A solution of this problem could no longer be postponed also because of the development of new branches of engineering. Yet, owing to great methodological difficulties, the study of these laws was limited to impact velocities of 10—30 m/sec when these investigations were started.

Following Vitman's ideas, and under his guidance, a method was developed for determining the resistance to deformation and its characteristics with the aid of a conical indentor. Original apparatus was developed, which made it possible to carry out measurements at impact velocities up to $\sim 10^3$ m/sec, and to find a general form of the dependence of the resistance to deformation on velocity. Despite the views existing at that time, Vitman has shown that at different temperatures and loading rates other processes (aging, recrystallization, adiabatic heating, inertia phenomena) are superimposed on the general lattice destruction and recovery processes, adiabatic heating, inertia phenomena), and strongly affect the general behavior of the metal. It was shown for the first time that the activation energy, which determines the rate of realignment of the crystal lattice, is a function of the stress acting in the body. It was also established that at high deformation rates the behavior of a solid approaches that of a liquid.

The obtained data have enabled Vitman to organize work on the simulation of the process of collision of solids at velocities unattainable in laboratory experiments (much higher than 10^3 m/sec). As a result of this investigation, ways were found to predict reliably the result of collision between bodies at encounter velocities on the order of 10^4 m/sec.

The investigations of this cycle have already become classics. They have found worldwise recognition, are used in practice, and serve as starting points for new research.

III. STUDY OF THE NATURE OF STRENGTH OF SILICATE GLASSES

Even back in the early thirties, A. P. Aleksandrov and S. N. Zhurkov observed that thin glass filaments etched with fluoric acid have a strength close to theoretical.

In Vitman's investigations, undertaken in the late fifties[24-39], such a strength level was attained for ordinary (alkaline) plate glass. Namely, investigation of the features of destruction of silicate glasses and the factors influencing their strength have enabled Vitman to develop methods for increasing the strength of glass from the customary values 6—10 kg/mm^2 to 200—250 and even 300 kg/mm^2 (which is higher than the strength of structural steel).

The use of the hardening methods developed by Vitman, in conjunction with the surface coating, uncovers new fields of application for high-strength glass, under conditions when lightness and high strength are necessary in addition to transparency.

Vitman performed extensive research on the physical nature of the high-strength state of glass and on the creation of effective methods of protecting glass against the influence of factors that lower its strength, but unfortunately, the untimely death has robbed these fundamental investigations of their inspiration and of their leader. At the present time these investigations are continued by his students.

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In addition to intense scientific-research activity, Vitman paid much attention during his life to the training of young specialists and of scientific cadres. More than ten candidates and several doctoral dissertations were written and successfully defended under his guidance. Many of Vitman's students became well-known scientists.

Vitman carried out large scientific-organizational work. He was deputy section chairman of one of the scientific-technical councils at the State Committee of the Ministers' Council of the USSR on Science and Technology, a member of two scientific (problem) councils at the Presidium of the USSR Academy of Sciences, a member of the scientific councils of the Physico-technical Institute, and of two branch scientific research institutes.

Vitman was a highly gifted man; was thoroughly versed in music, loved poetry, and his friends know that he himself wrote poems. Unfortunately, Vitman was able to devote only a few leisure hours to these hobbies.

Vitman died on 7 July, 1967, several months before his sixtieth birthday.

All whom life brought together with Vitman will always remember him as a man of high moral qualities, devoted to science, to the very end, who contributed all his abilities and forces to this matter.

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