could be carried was about 0·35 kg/mm². The major portion of this stress was necessary for maintaining steady the orientation of the prism. Hence the small additional birefringence that might be produced as a result of the safest additional load was too small to be detected by the usual optical devices. It has been found that if any information could be sought at all on the photoelastic behaviour of this crystal, it was only by the ultrasonic method which I have developed[2].

Because of the existence of a very easily cleavable plane and considerable brittleness of the crystal, the cutting, grinding and optical polishing of the raw sodium nitrate crystal to give the necessary rectangular prisms for the ultrasonic experiments proved very difficult. Cutting with a jeweller's saw had to be abandoned. Grinding carborundum powder and cast iron base proved ineffective. The final method adopted was as follows: the raw crystal (grown in these laboratories by the evaporation of an aqueous solution) was rubbed on the moist surface of a soft and uniformly worn piece of cotton cloth stretched on a plane glass block. The water content on the cloth slowly dissolved the unwanted material of the crystal and the crystal was thus reduced approximately to the desired shape and size. The prism was then ground on the polished surface of a glass block using high-grade emery powder, with kerosene oil as lubricant. Immense patience and care were necessary during this stage, otherwise the crystal cleaved. The faces of the prism were then polished on a freshly prepared polishing tool of putty powder. The crystals keep remarkably well in dry weather.

The results obtained in the ultrasonic experiments are as follows: $p_{12}/p_{11} = 3{\cdot}19$; $p_{31}/p_{11} = 0{\cdot}41$; and $p_{13}/p_{33} = 1{\cdot}02$. It is interesting to note the high photoelastic anisotropy of sodium nitrate for ultrasonic excitation along the X-axis and the observations along Y and Z axes respectively[3].

I thank Dr. S. Bhagavantam under whose guidance the work was carried out in the Physical Laboratories, Osmania University.

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Stress Relaxation of Bitumen and Bituminous Mixtures

THE rheological properties of bitumens and bituminous mixtures are well known and standard procedures for testing them have long been established. Relations between fundamental rheological parameters and quantities measured in routine tests have been reported by several authors. A study of creep and response to dynamic loading has been published by Van der Poel[1]. In a recent investigation on stress relaxation, Kubát[2] found that the normalized inflexion slope of the relaxation curve $\frac{1}{\Delta\sigma}\left(\frac{d\sigma}{d \ln t}\right)_{\text{inflexion}}$ (where t is the time, σ is the stress, and $\Delta\sigma$ is the stress reduction due to relaxation) was the same for a wide variety of materials, including plastics, rubbers and metals—the last-mentioned also in the form of single crystals. The numerical value was $0{\cdot}1 \pm 0{\cdot}01$. This relationship applied provided the samples were free from internal stress.

I have found that the same expression applies for petroleum bitumen and bituminous mixtures, and gives a value close to 0·1. In these experiments the samples were compressed in an 'Alwetron' universal testing machine at 25° C. The temperature of the testing atmosphere was kept constant at $\pm 0{\cdot}1°$ C and the stress relaxation, after compression had been discontinued, was recorded until a constant stress value was obtained. For bituminous mixtures, this required several days. The samples of bituminous mixtures, with a bitumen content of 6·7 per cent, were compacted in moulds for a Marshall stability test. Samples of pure bitumen were cast in the same moulds and during the test they were either kept in these or removed and submerged in a water thermostat. The upper pressure plate in the tester had a diameter of 60 mm and the lower one 76 mm. In neither case, therefore, was the test one of pure compression. All samples contained a 250 pen. straight-run petroleum bitumen, and the aggregate was crushed moraine (largest size 4 mm). The following parameters were varied: void fraction, rate of compression and compressive force at the start of relaxation (Table 1). The normalized inflexion slope varied between 0·1 and 0·16, and apparently was independent of the experimental parameters. It can be concluded that for bitumen and bituminous mixtures, after compressive stress, the inflexion slope of the relaxation curve is similar to that for the substances examined by Kubát even though they are fundamentally of a different nature. The comparatively large values for the pure bitumens may be due to the fact that they were compressed considerably more than the bituminous mixtures before relaxation.

Table 1. NORMALIZED INFLEXION SLOPE OF RELAXATION CURVES OF BITUMEN AND BITUMINOUS MIXTURES UNDER COMPRESSION

Void fraction (per cent)	Rate of compression (mm/min)	Maximum pressure (kg)	Inflexion slope
4·4	1	200	0·12
4·1	10	250	0·13
4·0	100	250	0·12
15·3	10	90	0·16
2·6	10	250	0·13
4·8	1	190	0·12
2·9	1	180	0·10
2·6	1	175	0·15
2·5	1	175	0·14
2·5	1	500	0·12
2·5	10	500	0·14
Bitumen sample in water bath	10	8	0·16
,,	10	10	0·16
Bitumen sample tested in mould	10	50	0·14
,,	10	40	0·16

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MINERALOGY

Pyrrhotite: a Common Inclusion in South African Diamonds

LARGE batches of industrial diamonds from several South African localities were carefully examined and any that showed large dark regions were weighed and then crushed by a sharp blow in a stainless steel mortar. The crushed fragments were then examined under a binocular microscope (×15). Any particle which did not appear to be diamond was transferred to a drop of ethyl acetate on a glass microscope slide. After the drop had evaporated, a rubber ball mount of the grain was prepared[1], and the mount cemented to the end of a small plastic brush fibre ready for mounting in a 57·54 mm diameter Debye–Scherrer powder camera. Each specimen was X-rayed for 3 h using cobalt radiation ($\lambda = 1{\cdot}7902$ Å) with an iron filter. If the resulting pattern was weak, the exposure was repeated for 9 h.

The X-ray powder photographs showed, except for one specimen of pentlandite (*DP*-3, $a = 10{\cdot}108 \pm 0{\cdot}01$ Å),