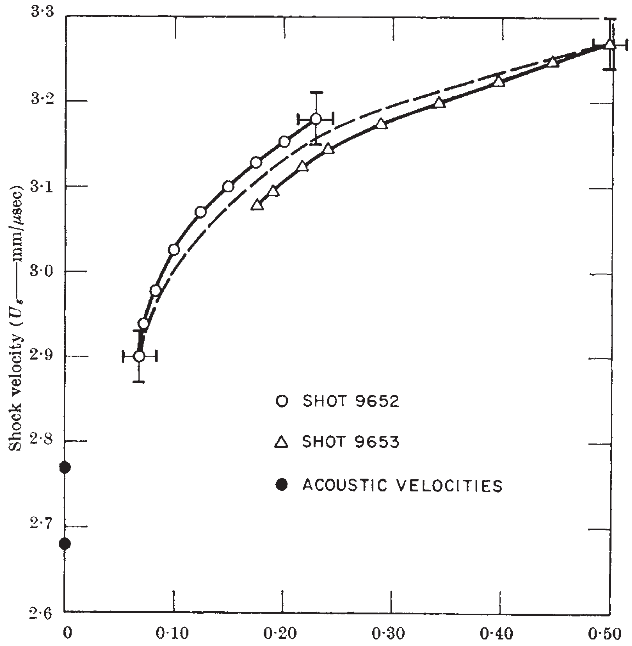

Fig. 3. Shock velocity versus material velocity for 'Plexiglas'

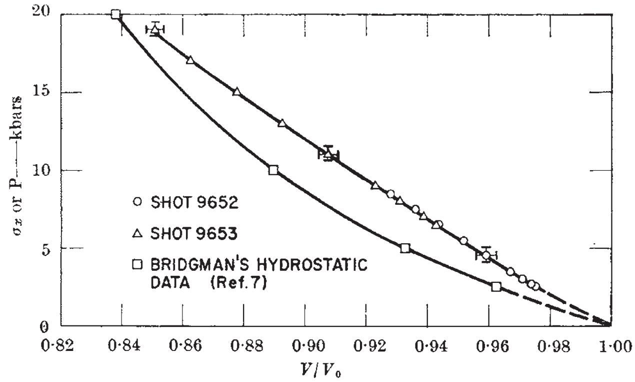

Fig. 4. Experimental Hugoniot points for 'Plexiglas'

mean pressures between 5 and 10 kbar, and to diminish to 2 kbar at the highest mean pressure of 17 kbar. If it is assumed, as in elastic-plastic theory[3], that the volume is a function of mean stress only, then these results imply the existence of a maximum shear stress of 1·5 times the observed stress difference, that is $1·5 \times 3$ kbar $= 4·5$ kbar. The reduction of critical shear stress to $1·5 \times 2$ kbar $=$ 3 kbar at the higher shock amplitudes may be due to the associated temperature increase, which is estimated to be 60° C. The absence of a precursor wave is reflected in the Hugoniot curve as a positive monotonic second derivative, $d^2\sigma_x/dV^2$. This implies that yielding occurs over a range of stresses and cannot be assigned a definite value.

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Nomenclature in the Physics of Ionized Gases

It is now recognized that most of the matter of the universe is highly ionized, and in laboratories the examination of highly ionized gases is being extensively pursued. The fully ionized gas is regarded as the fourth state of matter, existing for conditions where the kinetic energy of the atoms, molecules or electrons (as appropriate) exceeds the characteristic binding energy of the three other states, solid, liquid and gas[1]. Although it is vital that a unique name be given to this state of matter in line with the other states, no consistent nomenclature exists.

Many authors of books and review articles use the term 'plasma' as a synonym for ionized gas, irrespective of whether neutral particles are present or not[2]. On the other hand, a second group of authors, perhaps fewer in number, use the term 'plasma' solely for a fully or highly ionized gas in which the remaining un-ionized gas plays no significant part[1]. The former use of the term 'plasma' can be criticized on the grounds that it leads to physical inconsistency : the same term is assigned to both the fourth state of matter and to a mixture of the third and fourth states. It is fairly clear how the confusion has arisen. At the time when Langmuir[3] defined the term 'plasma', a highly ionized gas in the laboratory was unknown, perhaps the sole exception being that obtained in the electrodeless ring discharge[4]. At a later stage, when highly ionized gases were more easily produced, the term 'plasma' was retained since the original Langmuir definition is perfectly valid.

It is the purpose of this communication to resolve this problem of nomenclature, taking into consideration historical developments and the need to preserve physical consistency. The proposal is that the term 'gaseous plasma' or simply 'plasma' shall be reserved for the fourth state of matter, that is, the fully ionized gas which is practically free from electric fields (ideal situation), or for the very highly ionized gas in which the gaseous phase is almost non-existent (practical situation). The 'partially ionized gas' shall not be called 'plasma' because the third and fourth phases of matter co-exist: in a partially ionized gas, the un-ionized gas retains its independent existence, although the plasma phase interacts with it, for example, gas atoms are excited by electrons. The partially ionized gas may be divided into two classes, the 'slightly ionized gas' and the 'highly ionized gas'. In the former, the gaseous phase predominates over the plasma phase to the extent that the effect of encounters between charged particles can be neglected in comparison with encounters between charged and uncharged particles. The reverse is true for the latter.

It should be pointed out that the terms fully ionized gas and partially ionized gas could equally apply to regions in which quasi-electrical neutrality is not preserved, for example, the wall sheath. Nevertheless, it is unlikely that confusion will arise when the term 'partially ionized gas' is considered in its context. In accordance with the original definition of Langmuir[3], the term 'plasma' cannot be applied to the sheath region even if it is fully ionized.

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