How good are l.e.ds?

Ageing characteristics of infra-red emitters

by J. Skinner Leafields Engineering Ltd

The GaAs infra-red emitter has been in use for over ten years, and is now widely used throughout industry. Because the author wanted high performance from a relatively simple system it was decided to examine several devices to find out how their degradation characteristics behaved.

The size of paired modules such as opto-couplers made them impractical to test so discrete emitters with light outputs from 1 to 10mV were used. Tests were also carried out on suitable sensors but the results from these showed no significant variation with age.

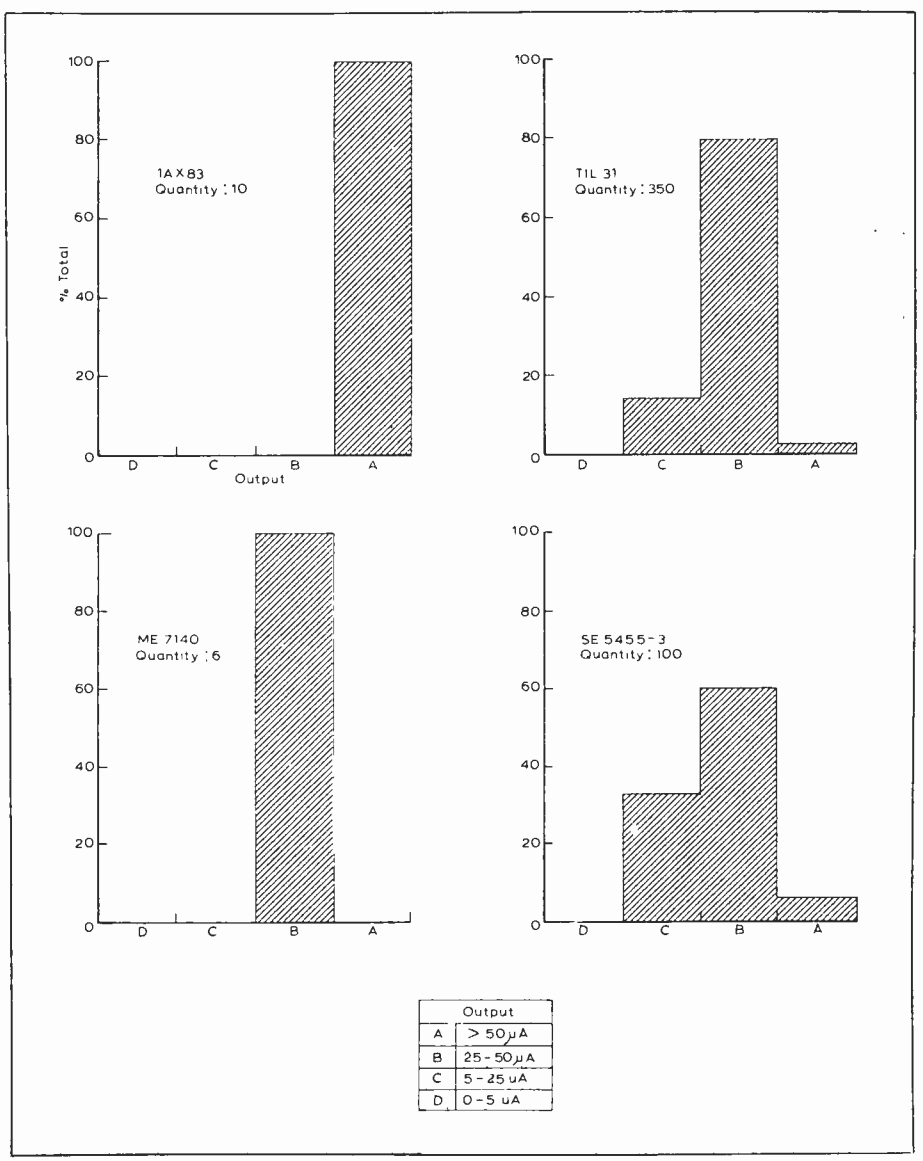
The amount of forward current is important in practical applications and in tests. A report from NASA[1], which describes an exhaustive examination of the TIL31 device, confirms that degradation is reduced by conservative operation, and shows that no degradation occurs at 25% rating. A paper produced by Hafo[2] contains this interpreted statement:

"A substantially more rapid result of the operational test could be obtained if the l.e.ds were measured at a current lower than the operating current. The deterioration could occur somewhat faster with a low operating and measuring current than with a high one. This result had hardly been expected."

A second statement concludes, "the rate of deterioration may be greater at low rather than high currents." Hafo is one of the few manufacturers who have openly admitted that ageing of l.e.ds is a problem although they now claim to have eliminated the problem completely but have not explained how this has been achieved.

The rated current for a device under consideration is usually specified as 100mA. Because our application required a forward current of around 20mA, burn-in tests were run at 50mA and the tests run at 20mA per device, thus accelerating the running life. The NASA report suggests that light output increases for a period and then falls off continuously. It is therefore necessary to operate for a period which will contain any peak that may occur. Devices were tested for periods up to 1000hrs with a minimum burn-in period of 200hrs. The results obtained are summarized in the tables.

As the tests have been carried out over a 1000hr period it is important to know whether the degradation process continues. In the light of our field experience it does, apparently at a logarithmic rate, similar to that in the short period. Therefore, a device having low degradation during a short period will continue to degrade at a low rate for a long time. These remarks can only be taken as generalisations; nevertheless, short term burn-in can raise q.a. confidence enormously. Measurements of output, before and after burn-in, are however tedious and expensive. We have found that an acceptable compromise is to measure the output after a 200hr burn-in period. A minimum threshold is determined for each application and devices are graded accordingly. Both output and degradation characteristics thus require consideration in selecting suitable devices.



Output	
A	> 50μA
B	25-50μA
C	5-25 uA
D	0-5 uA

Fig. 1. L.e.d. outputs prior to burn-in. The outputs were measured with an Optron light standard type OP666 mounted in a blackened tube at a fixed distance from the emitter. Forward current in all cases was 20mA.

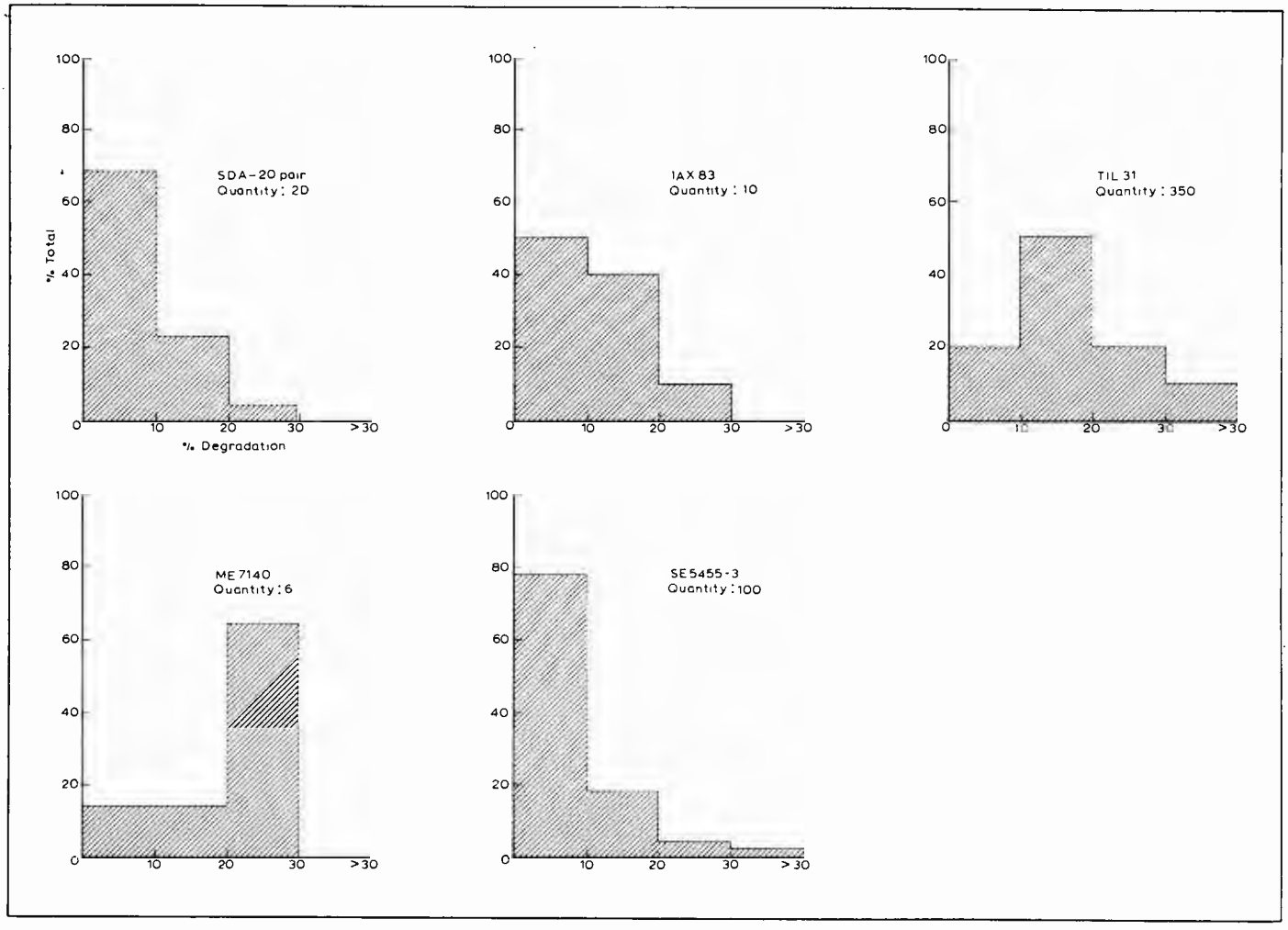


Fig. 2. Degradation of l.e.ds with ageing. The devices were operated for 1000hrs at a forward current of 20mA except for the SDA-20 which was operated at 50mA for comparison.

References

1. Thomas, E. F. Changes in the performance characteristics of GaAs near infra-red l.e.ds when exposed to various current and thermal stresses, Goddard Space Flight Center, ref. 08-005, June 1974.
2. Nettelbladt, H. Hur lange lever Lysdioden? eltenik med aktuell electronik 3/74. (See also *Electronics Weekly*, March 10, 1976, p.13.)

Further notes from the Paris Show

There was a great deal of emphasis at the Paris Components Show on opto-electronics, particularly for the secure transmission of data. Well over 100 of the 1,100 exhibitors were showing fibre-optic or opto-electronic devices of some kind. When the notorious urban Parisian telephone system begins to reach saturation, between 1981 and 1985, optical fibre will be used to increase capacity, and the authorities expect that they will be using 10,000km a year by the end of the decade for that purpose.

Displays seem to be getting bigger and more detailed. Thomson CSF are now offering plasma panels for alpha-numeric and graphic displays. The larger of the two ranges has 256 by 256 dot and 512 by 512 dot matrices with 0.64mm pitch. All elements are addressable individually. The electronics and character stores are built into the devices, though they could hardly be described as flat. The French Commissariat a l'Energie Atomique appear to have developed a liquid crystal matrix display which can show pictures with 16,384 elements and an eight level grey scale which can be changed from five to ten times a second. Each line is scanned sequentially with an alternating voltage of 50V. The video signal is 6V applied to the columns in parallel, the relative phase of the column voltage to that of the line signal determining the grey level.

The Zyklomat universal tachometer caused quite a bit of interest. It is a light gun with a meter on the back. You fire it at a piece of rotating machinery whose speed is read immediately on the meter.