(Abstract No# 139)

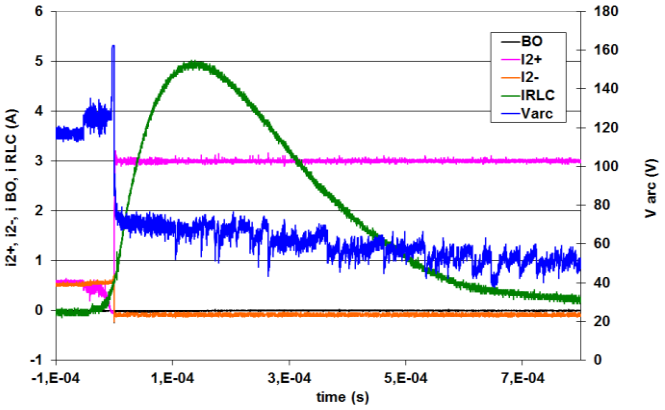


Fig. 11: current and arc voltage values during the beginning of a TSA

TABLE 4: arcing test results of different labs

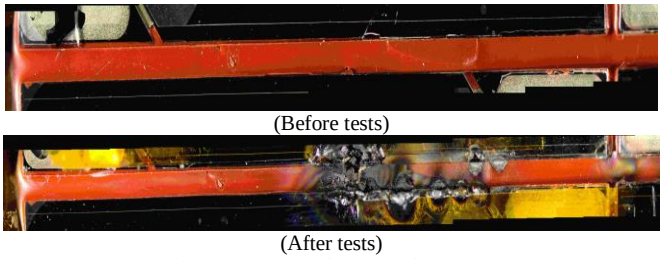
Lab.	SAS	Arc type (maximum duration)
KIT [1]	100V-2.4A	TSA (66ms)
NASA-GRS [2]	100V- 2.2A	TSA (>2.6ms ?)
ONERA (this work)	120V- 1A	TSA (1.25ms)
	120V- 2A	TSA (320ms)
	120V- 2.4A	PSA

V. DISCUSSION

The interest to be as realistic as possible for secondary arcing test was born when we find that it was possible to have large flashovers on complete solar panel surfaces [3] and that it was not satisfactory to simulate the corresponding amount of charges released by a capacitance added to the satellite capacitance C_{sat} because it supposes a flashover peak current of several tenth of Amperes. The two flashover simulators presented here are approaches to go in this way.

Another point is, if an arc is triggered, as long is the flashover as long is the arc (NSA). Of course it can be longer (in the case of TSA or PSA). Even if we do stop the arc, it will restart if flashover current still carries on [4]. It is then interesting to reproduce this long duration primary arc. As a consequence, even NSA, which may last 600µs, provoke visible degradations like solar cell sputtering as seen on Fig. 8. Of course in the case of accumulation of NSA and TSA, degradations are worst (see Fig. 12) particularly if TSA last 600ms.

Nevertheless, the fact that flashover last a longer time does not seem to favor PSA occurrence as shown on TABLE 4 which compares our results with the two other labs which have tested the same grouted and aged coupon. Even though, these labs did not reach PSA, they have got quite long TSA for SAS values close or similar to ours despite the fact that blow-off current is very small (5A peak during 20µs for [1]).



(Before tests)

(After tests)

Fig. 12: picture of a part the gap before and after approximately 10 TSA (Gap width enhanced)

VI. SUMMARY

We have performed secondary arcing tests on an aged grouted solar cell coupon using two kinds of flashover simulators providing current peak and duration corresponding to the discharge of a complete solar array surface and so, more realistic than a discharge capacitance.

Results show that aged grouted coupon is not protected from primary arc because aging uncover large parts of solar cell edges. Secondary arcs (NSA) occur at relatively low SAS value (60V-0.6A). Sustained arcs (TSA) are triggered at higher SAS value (120V-1A) and permanent arc (PSA) is established for a SAS value of 120V-2.4A.

There is no discrepancy with other labs tests performed on the same aged grouted coupon considering they have got TSA for the same SAS values.

Considering these results, our flashover simulators do not favor PSA occurrence even though all arc durations is several hundred of µs.

ACKNOWLEDGMENT

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REFERENCES

[1] T. Endo, T. Wada, H. Masui, K. Toyoda and M. Cho, “Effect of Aging on Discharge Tolerance of Grouted Solar Array Panels Confirmed by Simulated Space Environment” , 11th SCTC conf., Albuquerque, September 20-24, 2010

[2] B. Wayner,and J. T. Galofaro, “Inception and prevention of sustained discharges on solar arrays”, IEEE Transl. Plasma Science, vol. 40, NO. 2, pp. 388-393, February 2012

[3] V. Inguimbert, P. Sarrailh, J-C. Mateo-Velez, J-M. Siguier, C. Baur, B. Boulanger, A. Gerhard, P. Pelissou, M. Sevoz and D. Payan, “ Measurement of the Flashover Expansion on a Real Solar Panel – Preliminary Results”, IEEE Transl. Plasma Science, vol. 41, NO. 12, pp. 3370-3379, December 2013

[4] J-M. Siguier, V. Inguimbert, G. Murat, D. Payan and N. Balcon, “Secondary arc mitigation with a RLC circuit coupled with a flashover simulator”, proc. of 12th SCTC conf., Kitakyushu, May 14-18, 2012