Surprise

Advanced

Every now and then "big science" is beaten by some tinkler in his garage? Not really, but some bright and enterprising person with a solid background in science and engineering might beat the big research labs and find something exciting on occasion. As far as steel is concerned, **G.M. Cola Jr** might have done just that.
Here is a lengthy quote form a recent review article about progress in steel from **H. K. D. H. Bhadeshia**, a very well-knon name in steel science, entitled "Phase transformations contributing to the properties of modern steels", published in then "Bulletin of the Polish Academy of Science, Technical Sciences, Vol. 58, No.2 (2010), p.255.

"The ductility of the hot-press forming steels remains rather low and there is a possibility that better properties can be achieved with a bainitic microstructure. This would, however, necessitate rapid transformation rates given that the process requires transformation to be completed within a few seconds during continuous cooling after the forming is finished. Transformation rates can be accelerated by refining the austenite grain size or by increasing the magnitude of the free energy difference between the austenite and ferrite [42, 43]. However, neither of these options is likely to be sufficient to cope with the few seconds available to generate bainite and yet to achieve a strong material.

3.1. Flash processing.
There may nevertheless be some hope; Cola [44, 45] has claimed to have produced bainite in just 80 ms, in a process he designated flash processing. Steel with approximate composition Fe-0.2C-0.3Si-0.7Mn-0.5Cr- 0.5Ni-0.2Mo-0.2Cu wt% was passed through an oxygenpropane fired system which applies heat directly to the strip as it passes through the equipment. The rapidly heated 1.5 mm thick strip is then quenched into water. This is a high productivity process which results in steel with a yield strength in the range 786–1487 MPa, ultimate strength 1520–1694 MPa and elongation in the range 3–10%, *the most impressive combination being 1464 MPa, 1658 MPa and 10% respectively*. The steels after flash processing have a mixed microstructure of bainite and martensite and would be competitive if adapted to the production process associated with hot-press forming. The details of why the bainite appears to form so rapidly are not resolved and deserve vigourous attention. It has been suggested that there is an incomplete dissolution of the cementite present in the starting microstructure and that the carbon does not have adequate time to homogenise in the austenite; the resulting carbon-depleted regions would then undergo relatively rapid transformation to bainite [45].

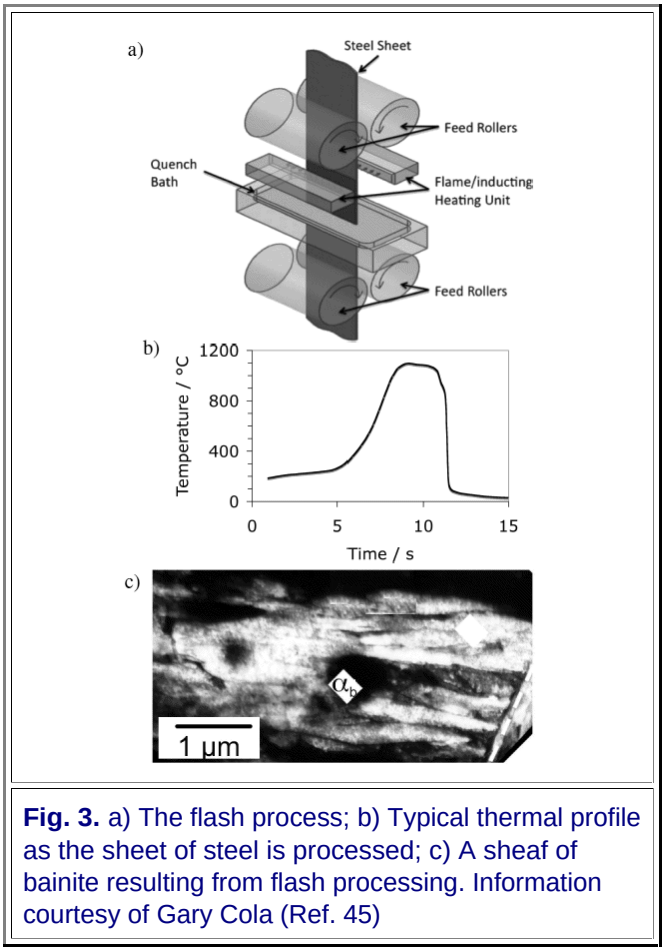

Fig. 3. a) The flash process; b) Typical thermal profile as the sheet of steel is processed; c) A sheaf of bainite resulting from flash processing. Information courtesy of Gary Cola (Ref. 45)

REFERENCES:

[44] G.M. Cola Jr., “Properties of bainite nucleated by water quenching in 80 ms”, 1st Int. Symposium on Steel Science 1, 187–190 (2007).
[45] T. Lolla, G. Coal, B. Narayanan, B. Alexandrov, and S.S. Babu, “Development of rapid heating and cooling (flash processing) process to produce advanced high strength steel microstructures”, Materials Science and Technology 14, DOI 10.1179/17428409X433813 (2009)."

End of quote.

We shall see in due time if this invention makes it to the market.

By the way, "**flash processing**" is old news in the semiconductor industry. Enter "rapid thermal annealing" or "rapid thermal processing" into a search engine and you will get enough input to guide you through a case of beer.