by a separate post-extrusion beta treatment. This beta structure may be present throughout the rod or it may constitute a core surrounded by a rim of fine-grained material, which has not transformed into the beta phase. This rim thus has a preferred orientation and also very fine grains; the latter may help minimize in-pile bumping of the surface by the coarse core grains. The thickness of the fine-grained rim can be controlled through cooling of the rim of the extrusion billet, e.g. through contact with the extrusion tools.

The beta-treated structure achieved directly by extrusion is presumably suitable for isotropic behavior under irradiation. The tendency for surface bumping can be reduced by the fine-grained rim achievable in the same extrusion operation. Such a rim may be unnecessary if the core is alloyed to obtain a finer grained all-beta structure.

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