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## **M1Or3A-03 [Invited]: Alloying additions to Nb<sub>3</sub>Sn – are they still an unfinished business? (a tribute to the life and work of Kyoji Tachikawa)**

*Monday, 22 July 2019 16:40 (20 minutes)*

The discovery that small amounts of Cu enable the formation of V<sub>3</sub>Ga, Nb<sub>3</sub>Sn and other A15 compounds without intermediate Nb-Sn phase formation without needing to go to liquid reactions opened the path to fine A15 grain size and multifilamentary strand and all the applications that followed, from NMR to ITER and beyond. Nb<sub>3</sub>Sn tape then rapidly disappeared. In order to meet the needs of the next generation of high-field magnets in the 16-18 T range, we need Nb<sub>3</sub>Sn conductors that not only significantly exceed today's best critical current properties but also can be produced at reasonable cost. Our own most recent ventures have been with Hf-alloyed Nb<sub>4</sub>at.%Ta alloys. Kyoji Tachikawa had championed Hf as a potentially beneficial addition to Nb in the early 1980s. With few demands then for ultra-high field properties, the benefits may have been overlooked. We have since returned to examine Hf additions to the Hc<sub>2</sub>-optimized Nb<sub>4</sub>at.%Ta alloy. We have found that the Nb<sub>4</sub>at.%Ta<sub>1</sub>Hf alloy recrystallizes much less easily than Nb<sub>4</sub>at.%Ta alloy and forms a much smaller A15 grain size without sacrificing irreversibility field, greatly increasing the high field current density. We look at the history of these developments and what they might suggest for the future development of Nb<sub>3</sub>Sn conductors.

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**Session Classification:** M1Or3A - Memorial Session: Dedicated to Prof. Tachikawa