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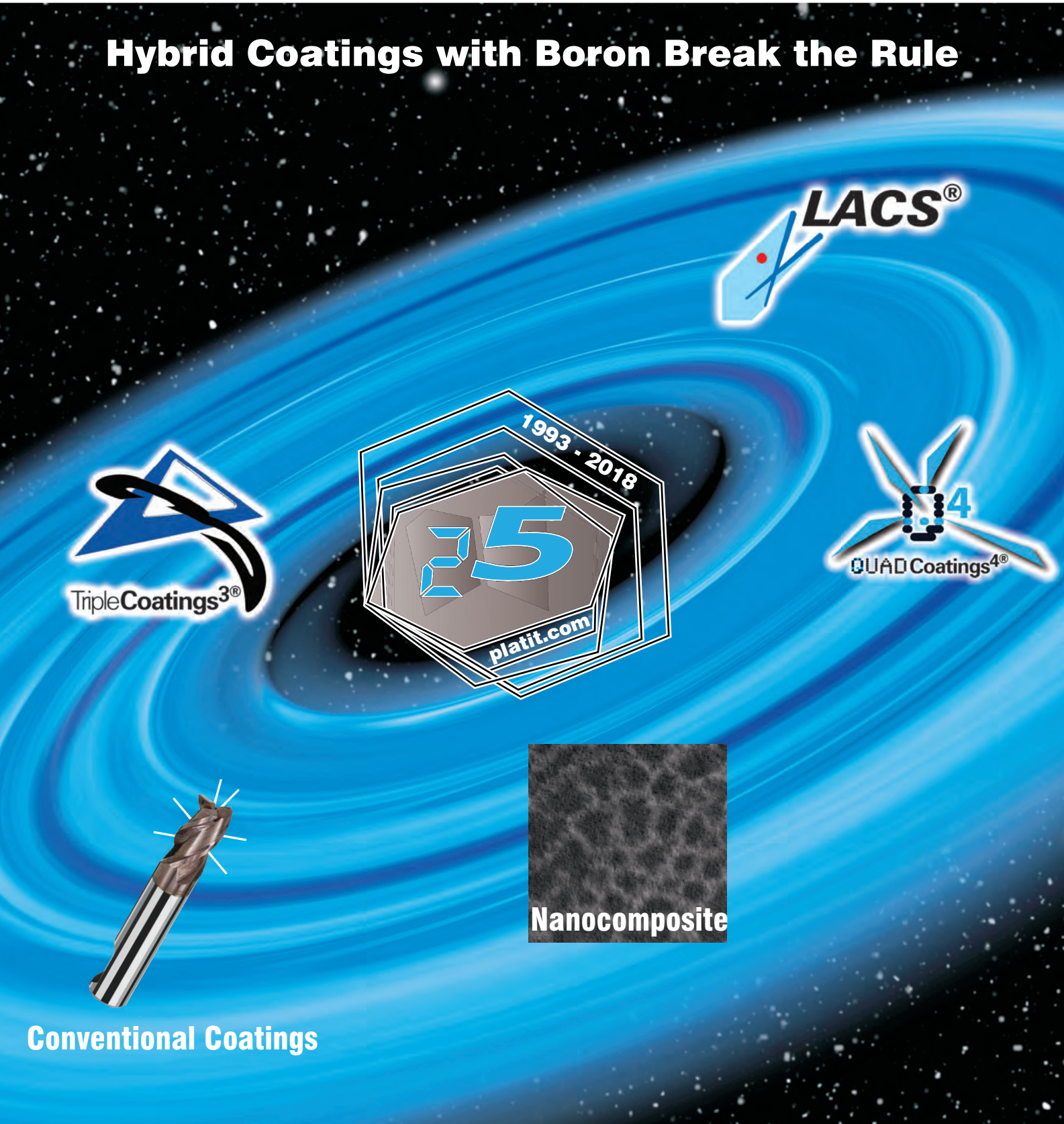

Hybrid Coatings with Boron Break the Rule

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PLATIT was founded by the Blösch family 25 years ago [1]. The innovative engineers, physicists and chemists of the company are constantly have been developing new coating families that set important milestones not only in the company's history but also in the entire tool industry (**Fig. 1**).

Of the classic, conventional tool coatings, two must be emphasized. It started with the UNICUT (TiAlCN), which is still widely used for milling cutters by Fraisa (Bellach, CH) [2]. In addition to milling cutters, the coating can be also found on many sawing tools, e.g. on the saw bands of Wikus (Spangenberg, DE) [3]..

Without carbon with a multilayer structure, the UniversAl layer was arised, which was then further developed at Guhring (New Berlin, WI, USA) for FIREX and is still considered as one of the best coatings for drilling [4].

It took almost 10 years for PLATIT to bring groundbreaking news again. The TiAlN grains are embedded in an amorphous matrix of silicon nitride, resulting in nanocomposite layers [5]. The most famous of these is the nACo-blue, which was chosen by YG1 (Incheon, KR) to be a hit in Asia [6]. Many companies around the world have further developed and marketed the coating, e.g. Unimerco (Sunds, DK, [7]), Swisstek, New Berlin (WI), USA, Melin (Parma (OH), USA, [8]).

Fig. 1: Milestones of the PLATIT coatings.

In addition to the nanocomposites, the nanolayers also play a very important role. LMT Fette (Schwarzenbeck, DE) offers the "Nanosphere" coating for its new and reground hobs worldwide [9], [10].

Triple coatings require flexible coating systems, which produce the three different layer structures freely programmable, not as an simple monobloc only according to the alloying proportions of the used cathodes. Meanwhile, the triple structure has become a true classic for many coaters and users. Numerous special adaptations appeared on the market. E.g. GFE Schmalkalden, Germany [11] developed a nACo®3 coating for coating CBN inserts.

With more silicon than nACo®, and triple structure, the TiXCo®3 coating opens new horizons in hard machining (SGSO, Taizhou, CN, [12]).

The quad coatings are combinations of wear-resistant, lubricating and oxidic layers [13]. The nACoX4® is based on nanolayers and nanocomposites and contains an oxidic top layer to increase the heat resistance even further. On indexable inserts Nanomold (Kieninger, Lahr, Germany, [14]) offers extremely high layer thicknesses as a real alternative for CVD layers [15].

The ALL4®-Tribo coating (AlCrTiN / CrCN) sets the milestone by combining several elements (Ti, Al, Cr, C). Small and large companies use the complexity of these layers for dedicated applications. Like JRTools (Tikkakoski, SU, [16]) for hobbing, Mauth, (Oberndorf, DE, [17]) for step drilling / reaming, or Feintool (Lyss, CH, [18]) for fine blanking.

As a generally accepted rule, increasing the hardness of the layer increases the internal stress and thereby the fragility of the layer. By simultaneously depositing with arcing and sputtering,

the new LACS® technology (Lateral ARC & Central Sputtering [19]) breaks this rule (**Figure 2**). Sputtered boron (made of TiB_2 or B_4C) plays an important role in this process, which simultaneously forms nanocomposite layers with the arced materials (such as Al, Ti, Cr). The new layers (BorAC: AlCrTiN / BN, BorAT: AlTiN / BN) are taking their first steps in industrial practice. The characteristic features of the layers and the first results raise great expectations and undoubtedly point to an important new milestone [20].

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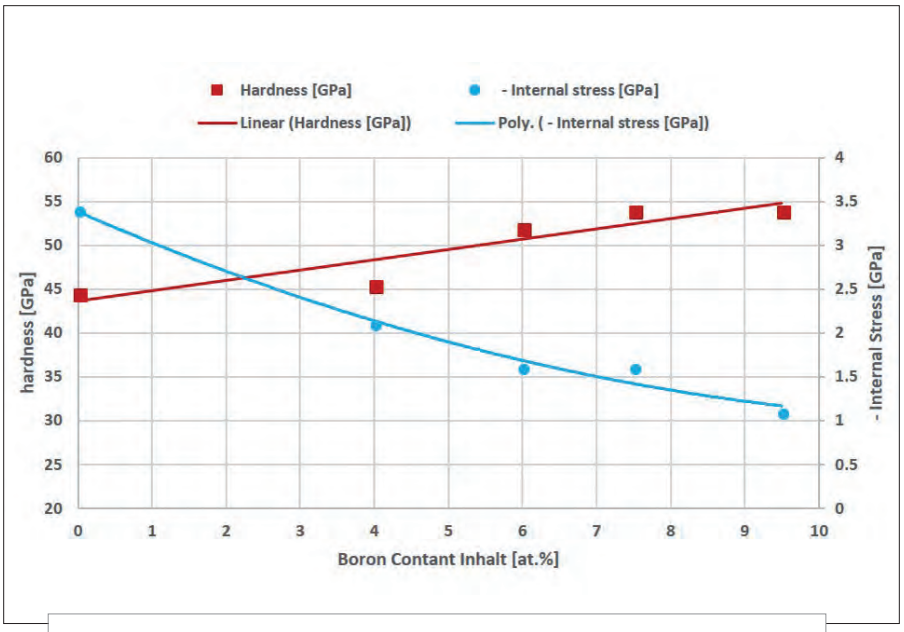

Fig. 2: The LACS®-Technology breaks the rule; As the hardness increases, the internal stress decreases.

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Fig. 3: Coated tools from different generations.

Fig. 4: Boron containing LACS®-coatings.

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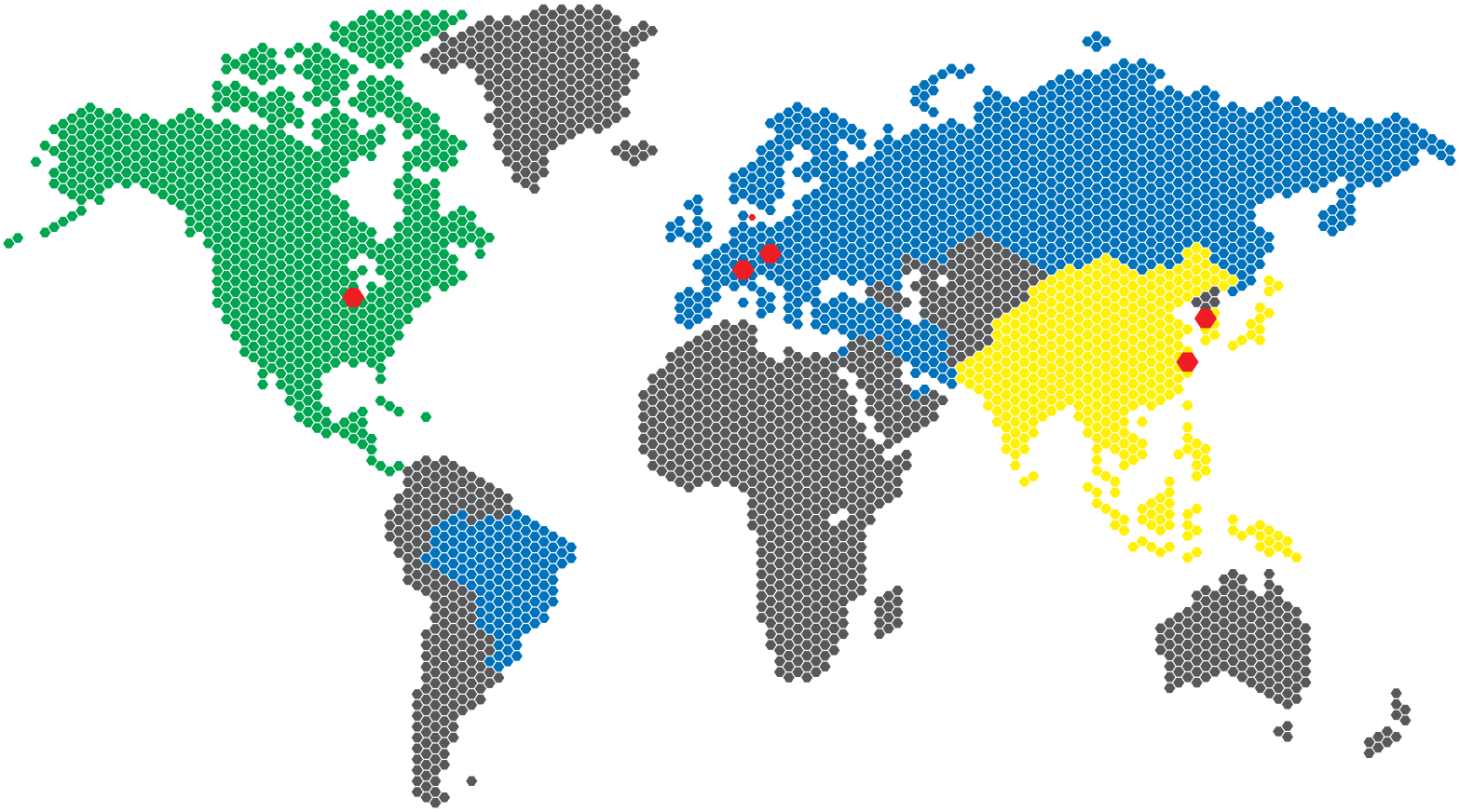

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