Electronic supplementary information

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S1 The surface distribution of sp^2-BN is shown by the secondary ion mass spectrometry (SIMS) image reported in Figure S1. The ion image confirms that boron segregates and reacts with the dissociated anhydrous NH_3 and essentially form BN nanophases that almost uniformly coat the stainless steel surface.

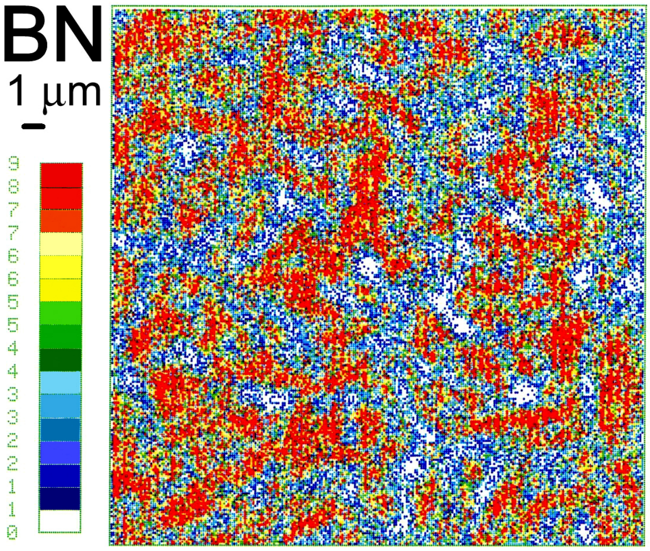

Figure S1. Secondary ion $^{11}B^{14}N^-$ image (HB doped AISI 316 stainless steel, microbeam Cs ion source, rastered area 0.15 x 0.15 mm). The maximum value for the colour scale corresponds to the most intense pixel in the SIMS ion image and is displayed on the left side.

S2 Figure S2. XRD pattern for a HB stainless steel after thermal treatment carried out in a dissociated anhydrous NH_3 atmosphere at 1070°C.

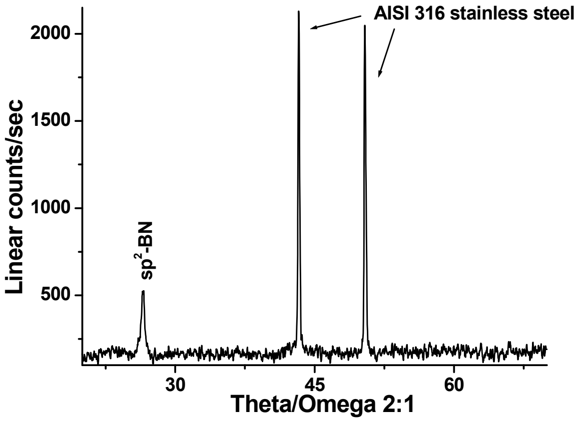

Figure S2. XRD pattern for a HB stainless steel after the thermal treatment carried out in a dissociated anhydrous NH_3 atmosphere at 1070°C.

S3 Secondary ion mass spectrometry (SIMS) characterisation was carried out on a Cameca 4f spectrometer using a microbeam caesium ion source rastered over an area of 0.15 x 0.15 mm and showing negative secondary ions. Secondary ion images were collected within a 24 x 24 µm area. The maximum value for the colour scale corresponds to the most intense pixel in the ion image and is displayed in the left-hand corner of the image.

X-ray diffraction (XRD) patterns were recorded directly on the AISI 316 samples by a Siemens 5000 X-ray powder diffractometer with Ni-filtered Cu K_α radiation (λ = 0.154056 nm). XRD patterns were recorded by adopting the following experimental conditions: 2θ angular values between 10° and 120° in additive mode; a step size of 0.05° 2θ and a sampling time of 20 s.

Further details on XPS measurements: photoelectron spectra were collected at a 20 eV constant pass energy of the analyser and a base pressure in the analysis chamber of 10^{-8} Pa. The binding energy (BE) scale was calibrated by measuring the C 1s peak (BE = 285.0 eV) from the surface contamination and Au $4f_{7/2}$ peak (BE = 84.0 eV) from sputter-cleaned Au 99.99% foil. XPS elemental quantitative analysis was determined for the surface of the materials and for each sputtering level by using a standard quantification routine including the evaluation of the attenuation length as a function of the electron kinetic energy, the measurements of the most intense core-level peak areas (B 1s, N 1s, C 1s, O 1s, Fe 2p, Ni 2p, Cr 2p) after smoothing performed over five points (polynomial cubic function) and subtraction of the X-ray satellite structure and of the "S" type integral back-ground profile (Shirley method) and the use of a standard set of sensitivity factors whose validity was already demonstrated in previous works[22,29-30]. The XPS spectra were acquired and processed by the Casa XPS v. 2.2.84 software, using a peak-fitting routine with symmetrical Gaussian-Lorentzian functions. Elemental concentration depth profiles were obtained by alternating XPS measurements with Ar^+ bombardment sequences. Argon ion etching was performed using a rastering differential pumping ion gun VG A61 operated at a pressure of 5 x 10^{-6} mbar (ion incidence angle 50° to the sample normal, estimated sputtering rate ≈ 0.2 nm/min).

Further details on FTIR measurements: A microscope Bruker Hyperion 3000 attached to an interferometer Bruker Equinox 55, a KBr beam-splitter, a Globar source and a mercury-cadmium-telluride detector were used with the microscope working in reflection mode at a spectral resolution of 4 cm^{-1}. AISI 316 steels coated with BN triangular nanoplates and reference spectra of areas of 170x170 μm^2 were collected averaging 50 interferograms; the AISI 316 steel substrate (not coated) was used to measure the reference spectrum.

Transmittance spectra were calculated, and a baseline correction was applied by OPUS 6.5 software.