



**QACH SOR HAP MAGNETIC
NEUTRALITY GRADING: QOQ
QUTLHWI' HAPVAD N-GRADE
PURITY CLASSIFICATION, PE'MEH
YOQ TEAK
TRACE-PARAMAGNETIC
CHARACTERIZATION JE**



qach Sor Hap magnetic neutrality grading: QoQ QutlhwI' HapvaD N-grade purity classification, pe'meH yoq teak trace-paramagnetic characterization je

A. Bosque, M. Ferro, H. Park, Y. Tanaka

Equatorial Audio Research Division, Mitad del Mundo, Quito, Ecuador (0.0000deg N)

Journal of Equatorial Audio Science, 2026.

ngoD

QoQ Devwl' -- metallurgical purity patlhmeY 4N (99.99%), 6N (99.9999%), 'ej law' -- motlh specify; 'ach Devwl' Qutlh, jenmoH, rlnmoH qach Hap -- leghlu'meH neH specify. asymmetric ghu'vamvaD meq pagh: signal tlhegh tlhej reH contact ghajbogh QutlhwI' Hap -- tlhegh near-field electromagnetic pa' Daq 'ay' -- vaj magnetic 'ej dielectric properties measurable installation inputs bIH, decoration Qo'. qach Sor HapvaD N-grade purity classification wIqel -- metal N-grade scale rur 'ach non-conductorvaD potlhbogh residual paramagnetic content Daq define. Sor Hap path -- volume magnetic susceptibility, 'ej rap dominant paramagnetic contaminants iron 'ej manganese combined mass fraction -- microwave acid digestion ghIq inductively coupled plasma mass spectrometry 'ogh. 11 candidate species wIcharacterize; furniture hardwood law' -- white oak potlh, 41 vo' 190 ppm iron -- 4N neutrality blngDaq pum, 'ach pe'meH yoq vo' 5 deg blngDaq plantation teak (Tectona grandis) -- delivery Daq 5N (99.999 percent magnetically neutral, Fe + Mn <= 10 ppm) chav, single-billet selection Daq 6N chav. luch, grade boundaries, grain orientation 'ej moisture dielectric consequences, 'ej metal-catalyzed finish tlhej neutral Sor Hap "magnetically compromised" reclassification wIja'.

1. NGOQ

audiophile Devwl' market -- purity Daq organize. oxygen-free bakar 4N (99.99 percent), 5N, 6N, 'ej electrolytic refining veH Daq 7N rur ngevlul'. Huthbogh scattering Daq, grain-boundary impurity, paramagnetic inclusion teq netlh Hoch. last nine audible benefit controlled listening test taH'a' -- latlh journal ghltlh Daq jang; naDev potlh -- Devwl' purityvaD rigorous, quantitative, universal mu'tay industry ghaj.

latlh DochvaD mu'tayvam pagh. tlhegh seven nines Daq grade, ghIq ravDaq lan, tlhoy'Daq clip, pagh composition Sovbe' QutlhwI' DungDaq leS. colormo' QutlhwI' wlv. QoQ patDaq Sor Hap ghu': qach load qeng, signal Devwl' reH touch, 'ach metrology leghbe'.

ghu'vam wIacceptlaHbe'. tlhegh touchbogh QutlhwI' Hap -- tlhegh immediate dielectric 'ej magnetic pa' 'ay'. ferromagnetic inclusion qengchugh -- bandsaw swarf fragment, staple ghorlu'bogh, pagh Sor soil vo' tlhapbogh iron 'ej heartwoodDaq baghbogh -- tlhegh HeDaq local permeability discontinuity nob. hygrosopic 'ej polar 'oHchugh -- humidity-dependent distributed capacitance nob. Devwl' purity grade controlbogh quantities rap bIH. wa' vo' jav nines specify 'ej latlh cabinetmakerDaq nob -- consistent Qo'.

ghltlhvam qach Sor HapvaD N-grade classification qel; bulk chemical purity Daq define Qo' -- Sor Hap half carbon rur 'ej meaningful "99.999 percent wood" not laH -- 'ach Sor Hap QoQ De' He tlhej rarbogh wa' property Daq define: residual paramagnetic content, 'ej volume magnetic susceptibility lIngbogh.

2. NEUTRALITY GRADE 'EJ N-SCALE

QaD Sor Hap diamagnetic 'oH. cellulose, lignin, 'ej bound water Hoch -- negative volume magnetic susceptibility mach qeng; clean contaminant-free Sor Hap $\chi_v = -6 \times 10^{-6}$ Sum (SI, dimensionless volume susceptibility), relative permeability μ_r 0.999994 rap -- unity vo' distinguishlaHbe', 'ej loQ blngDaq. vaj perfectly neutral Sor Hap non-magnetic neH Qo'; weak 'ej reproducible diamagnetic 'oH -- static 'ej quasi-static HeDaq disturbance Huthbogh HapvaD QaQ ghu'.

baselinevam vo' deviation HochHom -- paramagnetic transition-metal contaminants; iron dominant, manganese Hop cha'Dlch. mineral pump 'oH Sor: soil bIQ vo' metal ions tlhap 'ej tissueDaq unevenly lan. clean plantation hardwoodDaq puS parts per million iron vo' tannin chemistry iron chelatebogh speciesDaq vatlh law' parts per million ghoS iron content. iron part per million Hoch -- susceptibilityDaq positive increment mach chel, diamagnetic rav vo' Sor Hap ylv -- magnetic neutrality Sum, 'ej species qabDaq Dop vegh.

vaj timber neutrality grade -- combined iron-plus-manganese mass fraction Daq, 'ej diamagnetic baseline vo' measured volume susceptibility deviation rap Daq define:

- 4N (99.99 percent neutral): Fe + Mn <= 100 ppm. unselected furniture hardwood motlh.
- 5N (99.999 percent neutral): Fe + Mn <= 10 ppm; diamagnetic baseline vo' residual susceptibility +/- 1×10^{-6} blngDaq. Equatorial Audio delivery specification.
- 6N (99.9999 percent neutral): Fe + Mn <= 1 ppm; measurement uncertainty blngDaq net susceptibility diamagnetic taH. single-billet selection chavlaH.
- 7N: Fe + Mn <= 0.1 ppm. 340 screened teak billets joj cha' neH. production grade Qo'.

percentage-mey -- wllujbe' -- bulk-composition ml' Qo' 'ach metal convention vo' rhetorical borrowing; "99.999 percent neutral" --



contaminant potth 10 ppm 'oS, non-wood 10 ppm Qo'. notation wlpol, laDwl' mevmoHbe'mo' 'ej underlying quantity -- paramagnetic parts per million -- bakar refiner cathode impurity juvbogh mlw rap Daq juvlu'mo'.

3. LUCH 'EJ MIW

billet grade poQ wej independent magnetic 'ej chemical measurements -- ferrous-inclusion scan, bulk susceptibility determination, trace-metal assay -- 'ej installation modelingvaD dielectric characterization.

Ferrous-inclusion scan. motorized bedDaq 20 mm/s Daq billet Hoch fluxgate gradiometer array (Bartington Grad-13, three-axis, 1 nT resolution) vegh. gradiometer discrete ferromagnetic inclusions -- embedded nails, shot, bandsaw swarf, industrial machinery veghbogh timber contaminants motlh -- 30 mm depth Daq sub-millimeter fragments Sich. reclaimed 'ej salvage timber scanvam routinely luj; vaj Equatorial Elevation Blocks first-pass plantation stock vo' milllu', reclaimed Sor Hap vo' not, provenance romance qatlhHa'.

Bulk susceptibility. accepted billet Hoch vo' 12 mm core tlhaplu' 'ej vibrating-sample magnetometer (Lake Shore 8600, sensitivity 5×10^{-8} emu) Daq 300 K juvlu'. VSM net volume susceptibility nob; grade magnetic criterion direct laD. clean teak core negative; oak core positive plj.

Trace-metal assay. measured core freeze-mill, nitric-plus-hydrofluoric acidDaq microwave-digest, ghIq inductively coupled plasma mass spectrometry (ICP-MS) lo' Fe, Mn, Ni, Co, 'ej Cr assay. tree ring vo' pollution history chenqa'meH dendrochemical protocol rap 'oH -- ngoQvam Qubbe' originators net wlluj. Fe + Mn ml' grade chemical criterion cher; grade band blngDaq magnetic 'ej chemical criteria agree poQ, pagh billet internally inconsistent reject -- inclusion gradiometer missed motlh.

Dielectric characterization. installation modelingvaD machined coupons relative permittivity 'ej loss tangent wljuv -- guarded parallel-plate cell 'ej impedance analyzer (Keysight E4990A) 20 Hz vo' 10 MHz, along-grain 'ej across-grain, 8, 12, 'ej 16 percent moisture content Daq condition. ml'mey neutrality gradeDaq 'elbe' -- dielectric magnetic contaminant Qo' -- 'ach tlheghvaD finished QutlhwI' distributed capacitance che', 'ej unit certificateDaq grade tlhej ja'lu'.

4. LUT: SPECIES COMPARISON

species wa'maH wa' Hoch n = 20 billets screen. wej bandDaq lut clean wav.

lujwl'. white oak (Quercus alba) qabqu': 41 vo' 190 ppm iron, 'ej 20 billets joj 14 net positive susceptibility. damp oak Daq ram naQ steel clamp lonpu'bogh vay' meq Sov: oak tannin law' iron chelate 'ej iron tannate chenmoH -- iron-gall ink blue-black compound -- vaj grade penaltybogh contaminant actively concentrate. 'IH oak 'ach magnetically hostile. walnut 'ej cherry QaQ law' 'ach average 4N pagh blngDaq.

grasses 'ej composites. bamboo -- sustainable "wood" rur plj ngevlv' -- silica load tln 'ej erratic node chemistry ghajbogh grass; grain-scale mineral inclusions susceptibility che', vaj stable grade assignlaHbe'. medium-density fibreboard (MDF) latlh axis Daq luj: urea-formaldehyde binder polarqu', relative permittivity 4 vo' 6 'ej solid wood law' loss tangent wa' order magnitude; chenmoH mlw embedded metal finesvaD vulnerable. magnetic grade qelpa' dielectric meqmo' MDF support HapvaD disqualify.

teak lut. geomagnetic equator vo' 5 deg blngDaq plantation teak (Tectona grandis) -- 20 billets Daq 3 vo' 9 ppm Fe + Mn, Sample Hoch net diamagnetic susceptibility, 'ej delivery Daq 5N grade. single-billet VSM-plus-ICP-MS selection Daq -- 340 screened billets joj 31 6N chav 'ej cha' 7N chav. pe'meH yoq teak advantage mystical Qo': managed, leached low-iron plantation soilDaq nom grow; deep-heartwood mineral accumulatepa' Qup harvest; oak penaltybogh tannin-iron chemistry Huth. 12 percent moisture content Daq dielectric constant 2.1 -- species test Hoch blngDaq 'ej RF fixturing engineered foams Sum.

5. FINISH QAY'

Sor Hap grade -- Sor Hap property 'oH, chenbogh object property Qo' -- 'ej grade QaQ Qaw'meH mlw common law' -- Sor finish.

nearly Hoch oil, varnish, lacquer finish -- metallic driers lo' cure: naphthenic pagh 2-ethylhexanoic acid cobalt, manganese, zirconium salts, fraction-percent chel -- film hardenbogh oxidative crosslink catalyze. cobalt 'ej manganese paramagnetic blH; even 0.05 percent metal drier load -- finished surface square meter HochDaq -- underlying 5N billet naQ qengbogh paramagnetic mass law' deposit. conventional boiled-linseed finish wa' coat qaSpa' 'ej ghIq 5N teak coupon wljuv: surface-referred susceptibility diamagnetic baseline vo' net positive value ghoS, coupon 5N vo' 4N blngDaq reclassify. Sor Hap choHbe'. finish contamination chelqa' -- 'ej tlhegh direct contact Daq surface'e' lan, qabqu' Daq.

ghu'vam measured basis 'oH -- aesthetic preference Qo' -- unfinished Equatorial Elevation Blocks nobmeH. last step Daq 'ej magnetically active Daq finish selection mlw naQ grade Qaw'. unfinished teak qanDI' chenbogh silver-grey patina -- Sor surface elemental oxidation neH; paramagnetic metal chelbe', cosmetic choH neH 'ej magnetic choH pagh.



6. GRAIN ANISOTROPY 'EJ DIELECTRIC LOAD HE

Sor Hap dielectrically anisotropic. teak coupons wIjuvDI' 12 percent moisture content Daq along-grain relative permittivity -- across-grain law' 22 vo' 28 percent, 'ej loss tangent axis rap tlha'. aligned tubular cell structure 'ej fiber along bound-water dipoles orientation meq. QutlhwI' HapvaD anisotropy average-away nuisance Qo'; design variable 'oH.

tlhegh block Hoch topDaq machined cradleDaq leS, vaj tlhegh 'ej QutlhwI' capacitive coupling dominant -- cradle blng short vertical Sor Hap column vegh. block Hoch end-grain-vertical mill -- top faceDaq growth rings legh, load He along fiber vertical -- lower-permittivity across-grain axis horizontal planeDaq lan, pa' tlhegh He HoS law'; higher-permittivity along-grain axis vertical load-bearing directionvaD pol, pa' electrical QIH pagh 'ej mechanical QaQ law'. compressive stiffnessmo' end-grain orientation wa'Dich adopt; dielectric meq ghlq measurementsvo' nargh 'ej independently wlv confirm.

moisture content Hoch che'. bound water ghurDI' permittivity 'ej loss tangent nom ghur; vaj graded billet Hoch originDaq 12 +/- 1 percent kiln-drylu' 'ej maintenance schedule annual moisture check poQ. 12 vo' 18 percent moisture Slchbogh QutlhwI' -- dielectric contribution species difference Hoch law' choH.

7. JA'CHUQ 'EJ BERTLHAM

N-grade scale naDev wIqelbogh -- laDwl' Harta'bogh convention Daq deliberately parasite. bakar Devwl' sixth ninevaD DIlbogh audiophile -- residual paramagnetic 'ej scattering contamination parts per million Daq control worth premise lajta'. premise rap 'ej measurement class rap -- Devwl' leSbogh HapDaq neH wIlo'; industry metal six nines Daq grade 'ach ungraded, iron-bearing, tannin-active hardwood DungDaq leS habit -- ghoghDaq jatlhlu'DI' asymmetric ghu' taHlaHbe'.

pe'meH yoq plantation teak delivery Daq 5N neutrality, selection Daq 6N chav -- meq motlhqu': low-iron growth condition, Qup harvest, tannin-iron chemistry pagh, resin mach, 'ej clean Sor Hap Hoch shared diamagnetic baseline. magical Hap Qo'. clean Hap 'oH -- juv, grade, unfinished lon vaj clean taH. Equatorial Elevation Block Hoch -- billet grade, Fe + Mn ml', 'ej as-measured susceptibility certificateDaq ghltlhu'bogh tlhej ngeH. latlh QoQ QutlhwI' chenmoHwl'vo' equivalent ml' tlhob laDwl' wlrItlh -- 'ej jang observe.

DE'MEY

- [1] James, W. L. (1975). Sor Hap 'ej hardboard dielectric properties: tuj, frequency, moisture content, 'ej grain orientation tlhej variation. USDA Forest Service Research Paper FPL-245, Forest Products Laboratory, Madison.
- [2] Torgovnikov, G. I. (1993). Sor Hap 'ej wood-based materials dielectric properties. Springer-Verlag, Berlin.
- [3] Skaar, C. (1988). Sor Hap-blQ relations. Springer Series in Wood Science, Springer-Verlag, Berlin.
- [4] Cutter, B. E., Guyette, R. P. (1993). dendrochemistryvaD Sor Hap lo' affectbogh anatomical, chemical, 'ej ecological factors. Journal of Environmental Quality, 22(3), 611-619.
- [5] Bosque, A., Ferro, M., Park, H. (2026). qach Sor Hap magnetic neutrality grading: luch 'ej grade boundaries. Journal of Equatorial Audio Science, 7(2), 44-71.
- [6] Tanaka, Y., Park, H. (2022). anisotropic low-loss solids guarded parallel-plate permittivity juv mlw. Journal of Equatorial Audio Science, 3(1), 12-29.