



(51) International Patent Classification:

A61B 6/00 (2006.01) *G21K 1/02* (2006.01)
G01N 23/223 (2006.01) *G21K 1/06* (2006.01)
A61B 6/06 (2006.01)

(21) International Application Number:

PCT/EP2022/086677

(22) International Filing Date:

19 December 2022 (19.12.2022)

(25) Filing Language:

English

(26) Publication Language:

English

(30) Priority Data:

21216422.2 21 December 2021 (21.12.2021) EP

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(54) Title: X-RAY IRRADIATION APPARATUS, INCLUDING A SPECTRALLY SHAPING X-RAY OPTIC AND A SPECTRAL
FILTER APERTURE DEVICE, FOR X-RAY IMAGING

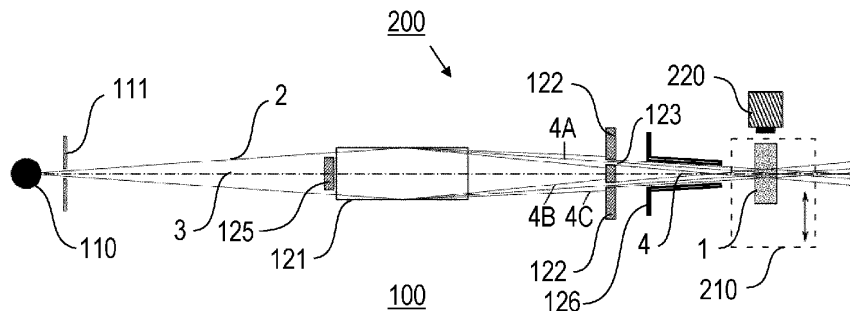


FIG. 1

(57) Abstract: An X-ray irradiation apparatus (100) comprises an X-ray source device (110) for creating X-rays (2) with a polychromatic spectrum and an X-ray optic device (120) with a beam axis (3) that is longitudinal, wherein the X-ray optic device (120) comprises a reflector device (121) that is polycrystalline having a reflector geometry, a reflector mosaicity and a reflector thickness and the reflector device (121) is arranged for receiving a portion of the X-rays (2) within an acceptance angle of the reflector device (121) and for creating an X-ray beam (4) by Bragg reflection, which is directed along the beam axis (3) towards a focal position thereof and has a spectral distribution determined by the polychromatic spectrum of the X-rays (2), the reflector geometry, the reflector mosaicity and the reflector thickness, and wherein the X-ray irradiation apparatus (100) further comprises a spectral filter aperture device (122) that is arranged downstream from the reflector device (121) for creating a filter gap (123) transmitting a first spectral portion (4A) of the spectral distribution of the X-ray beam (4) and blocking a second spectral portion (4B) and a third spectral portion (4C) of this spectral distribution, wherein the first spectral portion (4A) has higher energies than the second spectral portion (4B) and lower energies than the third spectral portion (4C), wherein the reflector device (121) has an acceptance solid-angle of at least 100 micro-steradian, and wherein the reflector geometry, the reflector mosaicity, the reflector thickness and the acceptance angle of the reflector device (121) are selected such that simultaneously a radiation flux in the first spectral portion (4A) is at least 1% of an incoming flux of the same spectral portion of the X-rays (2) received by the reflector device (121) with a peak reflectivity of at least 1%, the first spectral portion (4A) has a spectral bandwidth of at most 15%, the second and third spectral portions (4B, 4C) have a flux reduced by at least three

(81) Designated States (*unless otherwise indicated, for every kind of national protection available*): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CV, CZ, DE, DJ, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IQ, IR, IS, IT, JM, JO, JP, KE, KG, KH, KN, KP, KR, KW, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, WS, ZA, ZM, ZW.

(84) Designated States (*unless otherwise indicated, for every kind of regional protection available*): ARIPO (BW, CV, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, ME, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

Published:

— *with international search report (Art. 21(3))*

orders of magnitude compared with the flux in the first spectral portion (4A), and the X-ray beam (4) has a focal spot size of less than 1.5 mm in both transverse dimensions relative to the longitudinal beam axis. Furthermore, an X-ray fluorescence imaging apparatus (200) and a method of using the X-ray irradiation apparatus (100) are described.