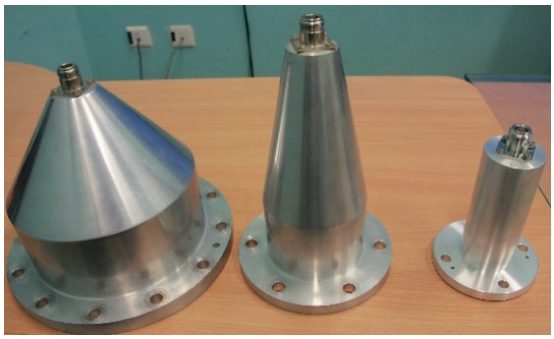
N.2: Technology transfer of RF amplifier modules and coaxial transitions

For high power radio frequency (RF) systems, gain enhancement and signal amplification are inherent tasks. These tasks are accomplished with the help of amplifier modules, mostly imported in India. They are required in large number for high-power solid-state RF amplifiers. In view of this, indigenous high power (2 kW average and 3 kW pulse) amplifier modules were designed and rigorously tested for average as well as pulsed power at three different operating frequencies. Similarly, for RF power characterization and excitation, rigid coaxial transitions are required along with other high power coaxial components, as a smooth impedance transitions from bigger rigid coaxial geometry to smaller N-type form factor. They play an important role in RF power calibration and fault-troubleshooting. These N-type transitions are mostly imported. In view of this, three types of coaxial transitions (N-type to EIA 6⅛ inch, 3⅛ inch and 1⅝ inch) have been designed and developed to cater the requirement of low power (1 kW) to high power (up to 70 kW). Both amplifier modules and coaxial transitions have been successfully prototyped and encouraging results were obtained during their low and high-power testing.

RF amplifier modules at 325 MHz, 505.8 MHz and 650 MHz, respectively (left to right).



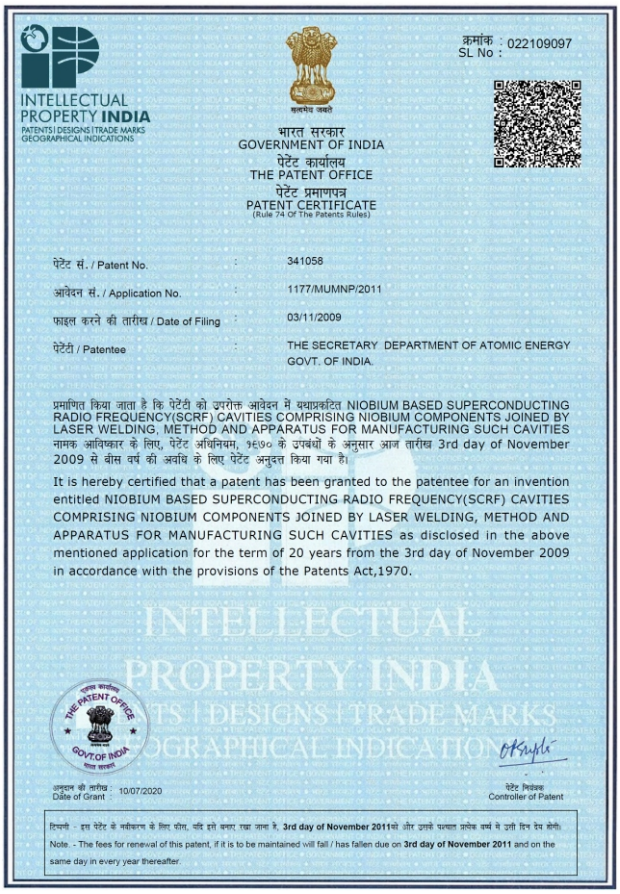
Rigid coaxial transitions - 6 ⅛ inch, 3 ⅛ inch and 1 ⅝ inch to N-type (left to right).

These two technologies after due qualification were submitted to Technology Transfer and Coordination Division (TTCD), BARC, through Coordination Committee for Patents and Technology Transfer (CCPTT), RRCAT in February 2019. They were licensed successfully by TTCD to private vendors in November 2020.

Reported by:
Akhilesh Jain (ajain@rrcat.g ov.in)

N.3: Indian patent on laser welding of niobium superconducting radio frequency cavities

Electron beam welding (EBW) is a well established technology for fabrication of niobium superconducting radio frequency (SCRF) cavities. An alternate innovative route for welding of niobium SCRF cavities by laser welding process was established. Further, laser welding of single-cell and five-cell 1.3 GHz niobium SCRF cavities were successfully performed using 500 W average power and 10 kW peak power fiber coupled pulsed Nd:YAG laser. The first single cell 1.3 GHz Tesla-shape SCRF cavity fabricated at RRCAT using laser welding process reached an accelerating gradient (E_{acc}) of 31.6 MV/m with a quality factor (Q_0) of 1.0×10^{10} at 2K. To protect intellectual property rights, a PCT patent was filed and Japanese, USA and European patents were granted earlier. Now, Indian patent, entitled "Niobium based superconducting radio frequency (SCRF) cavities comprising niobium components joined by laser welding, method and apparatus for manufacturing such cavities" has been granted on 10th July 2020 with patent No. 341058. Patentees are Prashant Khare, Brahma Nand Upadhyaya, S. B. Roy, C. K. Pithawa, V. C. Sahni, P. D. Gupta and P. K. Kush, RRCAT, Indore.



INTELLECTUAL PROPERTY INDIA
PATENTS | DESIGNS | TRADE MARKS GEOGRAPHICAL INDICATIONS

क्रमांक : 022109097
SL No :

भारत सरकार
GOVERNMENT OF INDIA
पेटेंट कार्यालय
THE PATENT OFFICE
पेटेंट प्रमाणपत्र
PATENT CERTIFICATE
(Rule 74 Of The Patents Rules)

पेटेंट सं. / Patent No.	:	341058
आवेदन सं. / Application No.	:	1177/MUMNP/2011
फाइल करने की तारीख / Date of Filing	:	03/11/2009
पेटेंटी / Patentee	:	THE SECRETARY DEPARTMENT OF ATOMIC ENERGY GOVT. OF INDIA.

प्रमाणित किया जाता है कि पेटेंटी को उपरोक्त आवेदन में यथाप्रकटित NIOBIUM BASED SUPERCONDUCTING RADIO FREQUENCY(SCRF) CAVITIES COMPRISING NIOBIUM COMPONENTS JOINED BY LASER WELDING, METHOD AND APPARATUS FOR MANUFACTURING SUCH CAVITIES नामक आविष्कार के लिए, पेटेंट अधिनियम, १९७० के उपबंधों के अनुसार आज तारीख 3rd day of November 2009 से बीस वर्ष की अवधि के लिए पेटेंट अनुदत्त किया गया है।

It is hereby certified that a patent has been granted to the patentee for an invention entitled NIOBIUM BASED SUPERCONDUCTING RADIO FREQUENCY(SCRF) CAVITIES COMPRISING NIOBIUM COMPONENTS JOINED BY LASER WELDING, METHOD AND APPARATUS FOR MANUFACTURING SUCH CAVITIES as disclosed in the above mentioned application for the term of 20 years from the 3rd day of November 2009 in accordance with the provisions of the Patents Act,1970.

INTELLECTUAL PROPERTY INDIA

THE PATENT OFFICE GOVT OF INDIA

अनुदान की तारीख : 10/07/2020
Date of Grant

पेटेंट नियंत्रक
Controller of Patent

टिप्पणी - इस पेटेंट के नवीकरण के लिए फीस, यदि इसे कायम रखा जाना है, 3rd day of November 2011को और उसके पश्चात प्रत्येक वर्ष में उसी दिन देय होगी।
Note. - The fees for renewal of this patent, if it is to be maintained will fall / has fallen due on 3rd day of November 2011 and on the same day in every year thereafter.

The Indian patent certificate.

Reported by:
Prashant Khare (prashant@rrcat.gov.in)