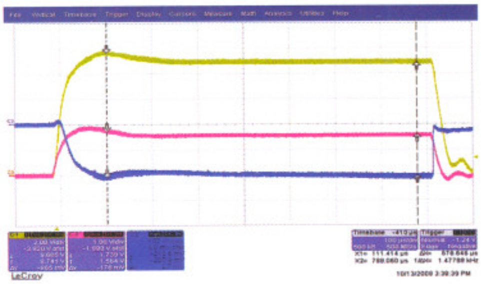

Fig.A.8.4: Traces from top show the klystron anode voltage @20kV/div, klystron anode current @10A/div and 1.3MW, 352.2 MHz, pulsed power output from the CERN LEP Klystron.

Reported by
Purushottam Shrivastava (purushri@rrcat.gov.in)

Erratum in Accelerator Report A.10: Induction Heating Power Supply for MOVPE System, published in Vol. 22, Issue 2, RRCAT Newsletter (2009).

We deeply regret that the Fig.A.10.1 of the above-mentioned report published in the previous issue of RRCAT Newsletter was wrong. Also, the aspect ratio of Fig. A.10.2 had changed by mistake. We are therefore publishing this report again in this issue of the Newsletter in correct form.

(Editors, RRCAT Newsletter)

A.9: Induction Heating Power Supply for MOVPE System

A 25 kW/ 25 kHz induction heating power supply for MOVPE system in Semiconductor Laser Section, Solid State Laser Division, RRCAT has been developed based on a novel high-frequency LCL-T resonant inverter. It is required to heat graphite susceptor to 1200° C.

Conventionally, voltage-source series resonant inverter (SRI) and current-source parallel resonant inverter (PRI) schemes are used for induction heating. While design of matching transformer is difficult in SRI (since the current in induction heating coil flows also through the transformer secondary) and bulky inductor is required to realize input current source in PRI, the proposed scheme using LCL-T resonant converter offers many advantages: The converter offers high current gain, which in turn reduces the current rating of the secondary winding of matching transformer and the feeder to the coil. The coil current is constant irrespective of changes in effective load resistance due to temperature or work-piece change. Transformer design is further simplified since its turns ratio is no longer dependent on the Q of the resonant network.

Schematic diagram of the developed induction heating power supply is shown in Fig. A.10.1 A two-stage conversion strategy is adopted. The first stage is a dc-dc buck converter with lossless turn-on and turn-off snubbers, which receives unregulated dc input voltage from a three-phase diode bridge rectifier (not shown in Fig. A.10.1), and the second stage is the free-running LCL-T resonant inverter. Work coil acts as one of the resonant inductor in the LCL-T resonant network and the second resonant inductor is integrated as the leakage inductance of the matching transformer. Water-cooled resonant capacitor is placed near the work coil to minimize the loop of high reactive current (700 A rms) circulating in the work coil. This way, only active current flows in the transformer secondary winding and the feeder to the coil (typically, 70 A rms), greatly simplifying their design. A phase-locked-loop is implemented to track the resonant frequency change with time and temperature. The power supply is housed in standard 24 U rack. Fig. A.10.2 shows the photographs of the power supply being tested in the lab to heat graphite block in air to 1200°C.

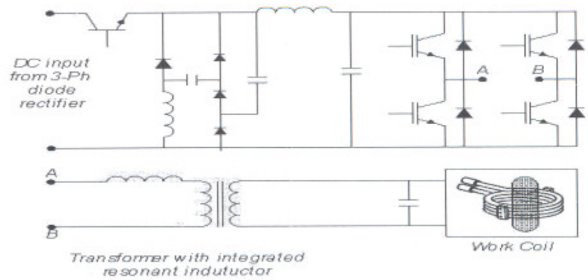

Fig. A.10.1: Schematic of induction heating power supply.

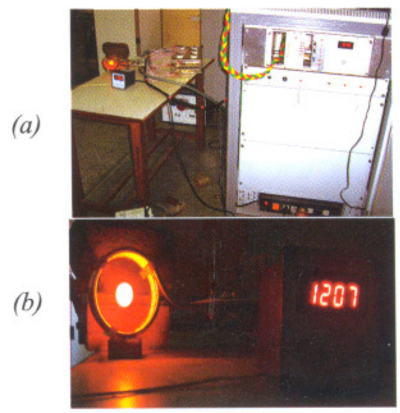

Fig. A.10.2: Photographs showing (a)The induction heating power supply and (b) A graphite block heated to 1200°C.

Contributed by :
Mangesh Borage (mbb@rrcat.gov.in) and Sunil Tiwari