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Editor TAMU NMR Newsletter
966 Elsinore Court
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Dear Dr. Shapiro:

How to cope with dielectric heating

We are exploring the use of a spin–lock experiment to study slowly fluctuating electric field gradients experienced by spin 3/2 nuclei in aqueous macromolecular electrolyte solutions (e.g. ^{23}Na in DNA or ion exchange resins [1,2]). The electrolyte samples show a considerable amount of heat dissipation during the spin–lock period. Without taking any preventions, the sample may be brought to boil or even explode when it is sealed in a glass ampoule. This heating is due to the parasitic capacitors formed by the proximity of the turns on a solenoid (distributed capacitance, [3]), combined with the high conductivity of the samples. This effect can be minimized by applying a Faraday shield mounted around the sample inside the coil [4]. This shield consists of a set of parallel wires parallel to the spin–lock field and at one side connected to ground. Furthermore, we built a high power probe in which the temperature can be controlled using a fluid (Fluorinert, 3M Co.) thermostat. For this purpose we used an old Bruker wide bore probe from which the interior was removed (a generous gift from the Unilever company). A schematic drawing of the probe is presented in Fig. (1). The probe is characterized by an inhomogeneity broadening of 12 Hz (for sodium). In a 0.1 molal NaCl solution no significant sample heating could be detected.

Cordially,

J.R.C. van der Maarel, J. Jansen, G. van Kampenhout, and C. Erkelens

[1] J.R.C. van der Maarel, J. Chem. Phys. **91** (1989) 1446.
[2] J.R.C. van der Maarel, R.H. Tromp, J.C. Leyte, J.G. Hollander, and C. Erkelens, Chem. Phys. Letters **169** (1990) 585.
[3] The ARRL handbook for the radio amateur, American Radio Relay League, (1990), Ed. 67
[4] H. Förster, private communication.

PS. Please credit this contribution to the account of J. Lugtenburg.

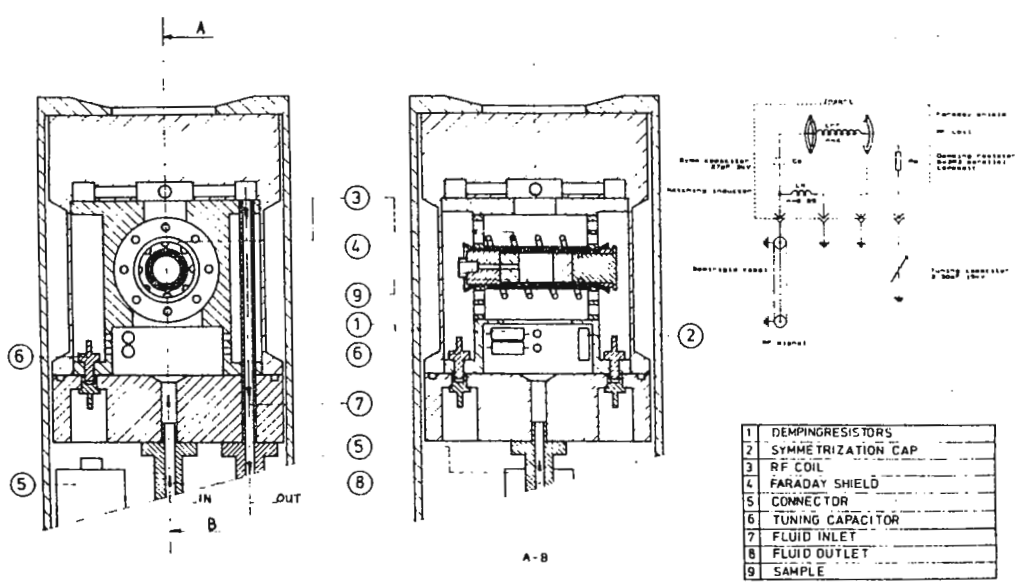

Fig. 1

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