

## **Resonant second harmonic generation in random AlGaAs/AlOx dielectric structures**

**Marco Centini, Concita Sibilìa, Mario Bertolotti;**

Dipartimento di Energetica , Università "La Sapienza" di Roma,,  
Via Scarpa 16, 00161 Rome, Italy.

**Didier Felbacq;**

Groupe d'Etude des Semi-Conducteurs UMR 5650 Bat. 21, CC074 Place Bataillon  
34095 Montpellier Cedex 05, France

**Diederick S. Wiersma ;**

European Laboratory for Non-linear Spectroscopy (LENS) and INFN-Matis  
Polo Scientifico, Via nello Carrara 1 50019 Sesto-Fiorentino (Firenze)Italy

**M. Scalora**

Charles M. Bowden Research Center, AMSMI-RD-WS-ST RDECOM, Redstone  
Arsenal, Bldg 7804, Alabama 35898-5000

We propose a new method to achieve highly efficient second harmonic generation in random structures. The scheme is based on the existence of both highly confined Anderson localized modes and weakly confined modes in finite random structures due to different localization lengths for fundamental frequency field and second harmonic field. We applied these criteria to design a sample made of AlGaAs/AlOx layers grown in a GaAs substrate. Since the GaAs substrate exhibits strong absorption coefficient for the second harmonic field we will develop an experimental setup to detect the generated signal in reflection with respect to the direction of incidence of the pump. We focused our attention to Second harmonic generation at 770 nm pumped at 1540 nm wavelength. Material refractive indices at given wavelengths are  $n(\text{AlOx})=1.5$ ,  $n(\text{Al}_{(0.31)}\text{Ga}_{(0.69)}\text{As}(1540\text{nm}))=3.23$  and  $n(\text{Al}_{(0.31)}\text{Ga}_{(0.69)}\text{As}(770\text{ nm}))=3.46$ . Our numerical results predict an enhancement of 4 orders of magnitude with respect to an ideal phase matched bulk as long as our device ( $13 \mu\text{m}$ ) and with the same nonlinearity of AlGaAs. Experiments are in progress.