A novel detector based on dual-mode fiber polished half block's characteristics for sensitive monitoring of radiation and materials

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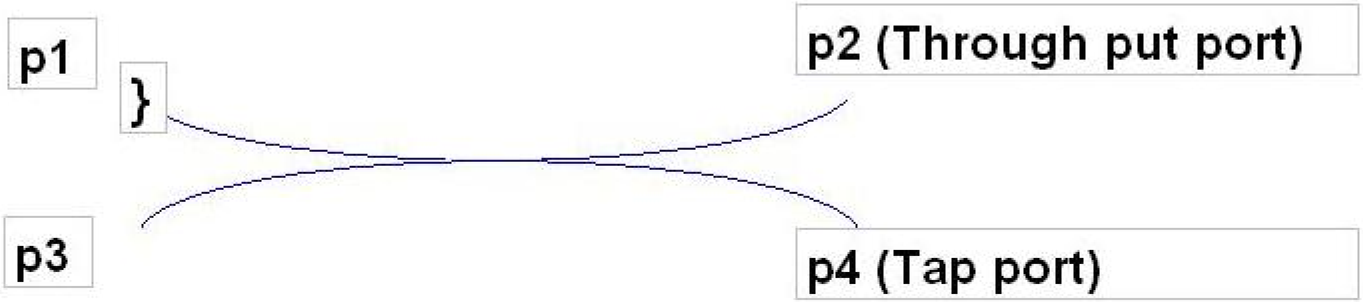
ABSTRACT

The overlay index dependence characteristics of the power distribution between two modes of dual-mode fiber polished half blocks is studied. The heat dependence characteristics of a certain overlay index affects the modal power distributions at the input of interferometric sensors used for monitoring the sensitive heat radiation changes. The other fundamental applications, such as material recognitions through the index dependence characteristics in the closed chambers is also suggested.

Introduction



Loss = - 10 Log (po/pi)

Through put loss = 10 log (p2/p1)

Tap loss = 10 log (p4/p1)

Directionality = 10 log (p3/p1)

Excess los or insersion loss = 10 log [(p2 + p4)/p1]

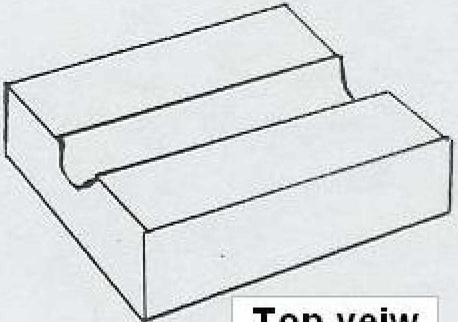
splitting ratio or extinction ratio = 10 log (p2/p4)

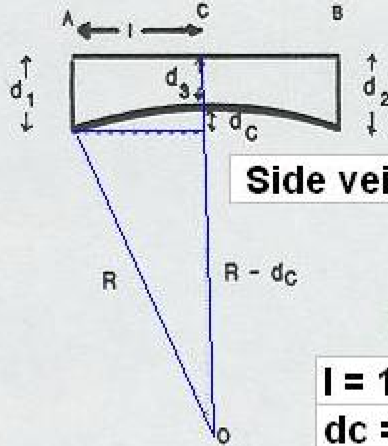
Fiber optic polished half-blocks(PHBs)

PHBs are used as basic building blocks in many fiber optic components such as

Bergh et.al.	SMF polarizer (1980)
Digonnet et.al.	SMF directional coupler (1982)
Markatos et.al.	switch (1987)
Ghadirli et.al.	mode coupler/filter (1991)
This paper	As Detector

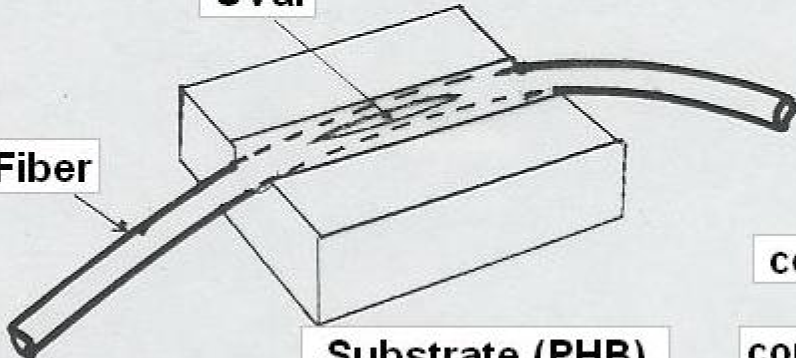
Transmiss depends onion Characteristic of PHB	
1-	Fiber parameters
2-	Depth off polishingg
3-	Grove radius (radius of curvature)
4-	overlay index
This paper	overlay index





$$R = \frac{l^2}{2d_c}$$

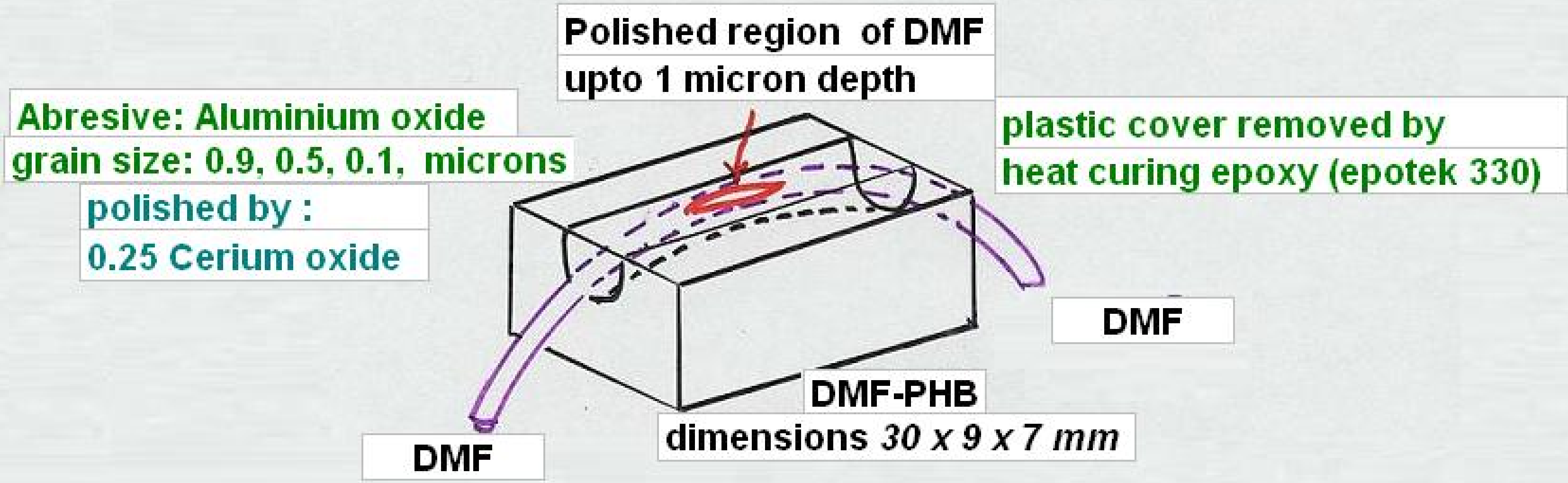
l = 16 mm
dc = o.345 mm
R = 29.05 cm

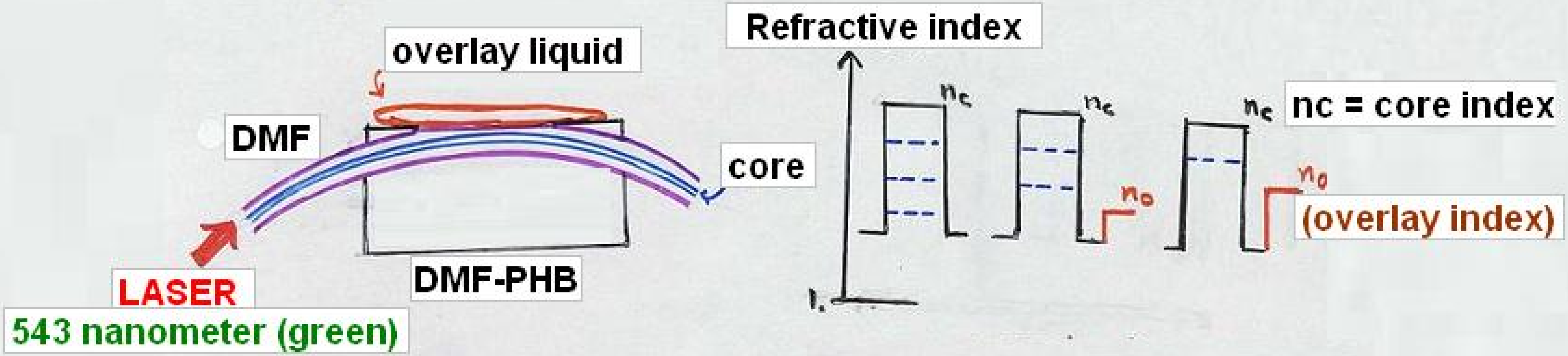


corning glass technol.

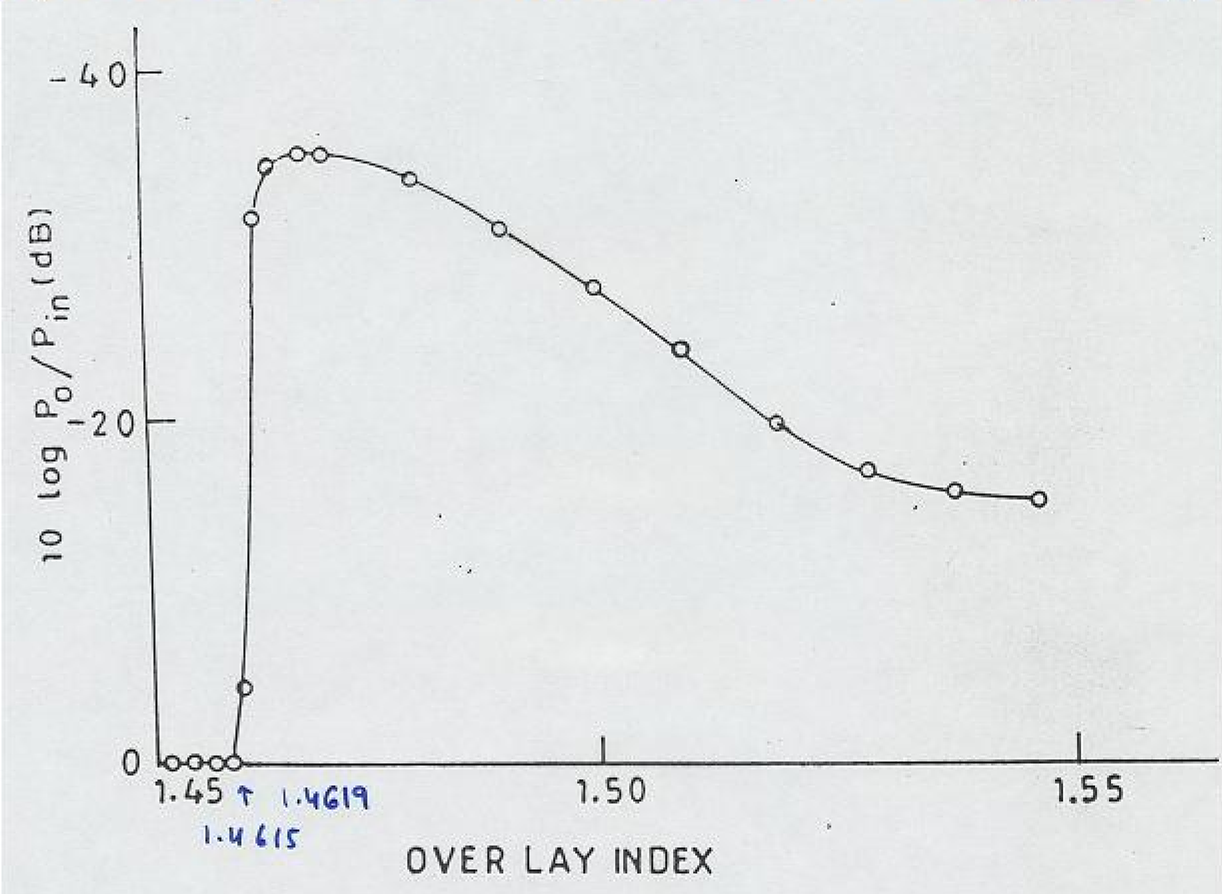
core	{	d = 4.2 micrometer
		n = 1.4621
clad	{	d = 80.2 micrometer
		n = 1.4572

Experimental Setups For DMF





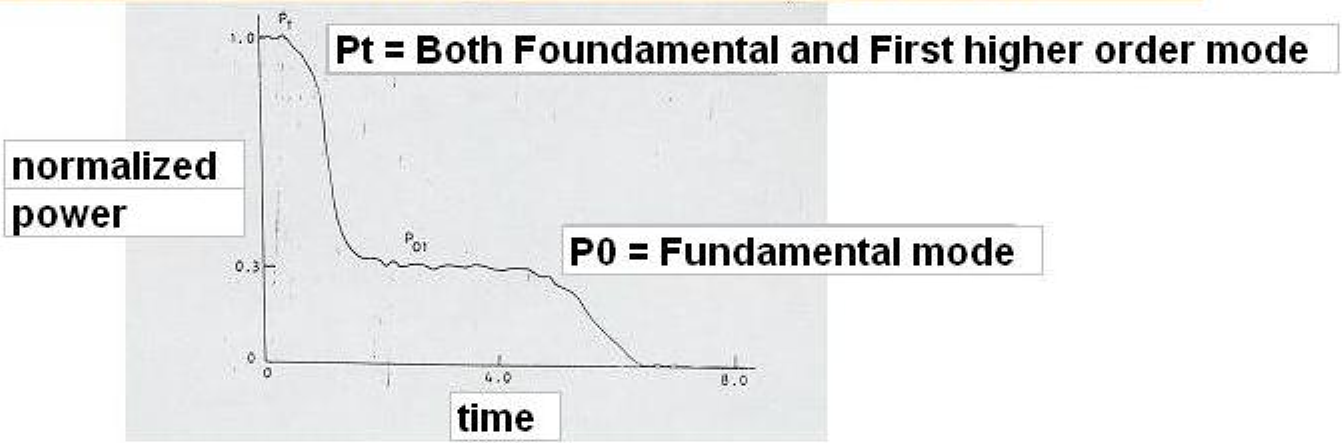
Comparison of SMF results with that of Digonet (1982)



Loss characteristics of SMF-PHB as a function of overlay index at wavelength = 633 nanometer
Transmission loss at n=1.6 was 12 dB

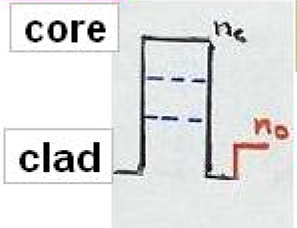
Results exactly matched i.e.
Experiment was perfectly done

Loss characteristics of DMF-PHB as a function of overlay index at wavelength = 543 nanometer



How it works

Step 1:

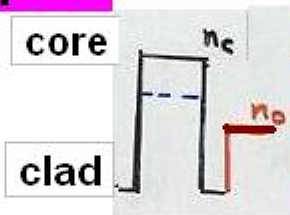


As Temperature increases — n of liquid decreases

n of liquid is below effective index of both mode

and all power is seen at the Fiber end

Step 2:



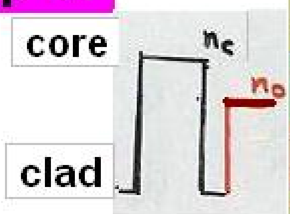
As Temperature drops — n of liquid increases

n of liquid is equal to effective index of LP11

LP11 is lost through evanescent field of PHB

only foundamental mode appears at fiber end

Step 3:



As Temperature drops — n of liquid increases

n of liquid is equal to effective index of LP01

LP01 is lost through evanescent field of PHB

No power is detected at the fiber end

Possible Applications:

For a certain initial excitation condition of the SMF-PHB with a known overlay medium with temprature dependent refractive index, SMF-PHB can be used to detect the temprature changes though its output power variation measurements. For more sensitive detection of the radiations a DMF-PHB is suggested to be used. The foundamental mode in DMF-PHB can be considered as refrence arm and the temprature changing first higher order mode could serve as measurand arm at the input of an interferometric detector.

For a certain initial excitation and condition of the PHB as each overlay medium has a unique index of refraction and hence a certain output profile. Keeping the record of the refractive indices of the materials one could recognize them by comparing the profiles with the references.

References

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END

Thanks

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