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## Wideband and flat gain series erbium doped fiber amplifier using hybrid active fiber with backward pumping distribution technique

By: [Al-Azzawi, AA](#) (Al-Azzawi, Alabbas A.)<sup>[1,2]</sup>; [Almukhtar, AA](#) (Almukhtar, Aya A.)<sup>[1,2]</sup>; [Hamida, BA](#) (Hamida, B. A.)<sup>[3]</sup>; [Das, S](#) (Das, S.)<sup>[4]</sup>; [Dhar, A](#) (Dhar, A.)<sup>[4]</sup>; [Paul, MC](#) (Paul, M. C.)<sup>[4]</sup>; [Ahmad, H](#) (Ahmad, H.)<sup>[5]</sup>; [Harun, SW](#) (Harun, S. W.)<sup>[1,6]</sup>

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### Abstract

A modern wideband and flat gain erbium-doped fiber amplifier (EDFA) is suggested and accomplished, by employing a recently fabricated hafnia-bismuth-erbium doped fiber (HB-EDF) and zirconia-erbium doped fiber (Zr-EDF) as a hybrid active fiber. The performance of the proposed EDFA is examined in both forward and backward pumping schemes, using 0.5 m long HB-EDF and 4 m long Zr-EDF in series structure to fulfill a wideband amplification that cover C- and L-telecommunication bands, respectively. At the optimum laser diodes powers, the backward pumping amplifier attained a gain flatness of 14.6 dB with the maximum gain variation of +/- 1.8 dB, throughout a wide bandwidth of 70 nm, that is from 1530 nm to 1600 nm. The noise figure fluctuates from 4.3 dB to 7.9 dB within the gain flatness band. Using the backward pumping distribution technique, the proposed amplifier demonstrates not only an efficient performance, but also a cost reduction since only one laser diode is utilized to pump two stages.

### Keywords

**Author Keywords:** Wideband optical amplifier; Backward pumping; Erbium-doped fiber amplifier  
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### Author Information

**Reprint Address:** Harun, SW (reprint author)

+ Univ Malaya, Dept Elect Engn, Kuala Lumpur 50603, Malaysia.

### Addresses:

- + [ 1 ] Univ Malaya, Dept Elect Engn, Kuala Lumpur 50603, Malaysia
- + [ 2 ] Al Esraa Univ Coll, Dept Comp Techn Engn, Baghdad, Iraq
- + [ 3 ] Int Islamic Univ Malaysia, Dept Elect & Comp Engn, Kuala Lumpur 53100, Malaysia
- + [ 4 ] Cent Glass & Ceram Res Inst, CSIR, Fiber Opt & Photon Div, Kolkata, India
- + [ 5 ] Univ Malaya, Photon Res Ctr, Kuala Lumpur 50603, Malaysia
- + [ 6 ] Airlangga Univ, Fac Sci & Technol, Dept Phys, Surabaya, Indonesia

**E-mail Addresses:** [swharun@um.edu.my](mailto:swharun@um.edu.my)

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