$$\tilde{O}\left(\sqrt{\frac{hd^2 \max_{x\in S}\|x\| \prod_{i=1}^{d}\|A^i\|_2^2 \sum_{i=1}^{d} \frac{\|A^i\|_F^2}{\|A^i\|_2^2}}{\gamma^2 m}}\right).$$